The ELECTRICAL REVIEW

FOUNDED 1872

Vol. CXVII
No. 3019

[All Rights Reserved]

OCTOBER 4, 1935

[Registered at G.P.O. as a Newspaper and Canadian Magazine rate of postage]

PRICE SIXPENCE

'ENGLISH ELECTRIC' FIRES

No. HH113. 1 kW. Chromium - plated reflector & tubular frame.

No. HH114. 1 kW. Chromium-plated reflector.

EXAMPLES FROM THE RANGE

No. HH140. 1 kW. Also made in 2 kW. size.

No. HH102. 2 kW. Also in 1 kW. & 3 kW. sizes. Vitreous enamel finish.

No. HH143. 2 kW. Also made in 1 kW. size. Vitreous enamel finish.

No. HH150. 2 kW. Finished Oxy-silver or Oxy-bronze.

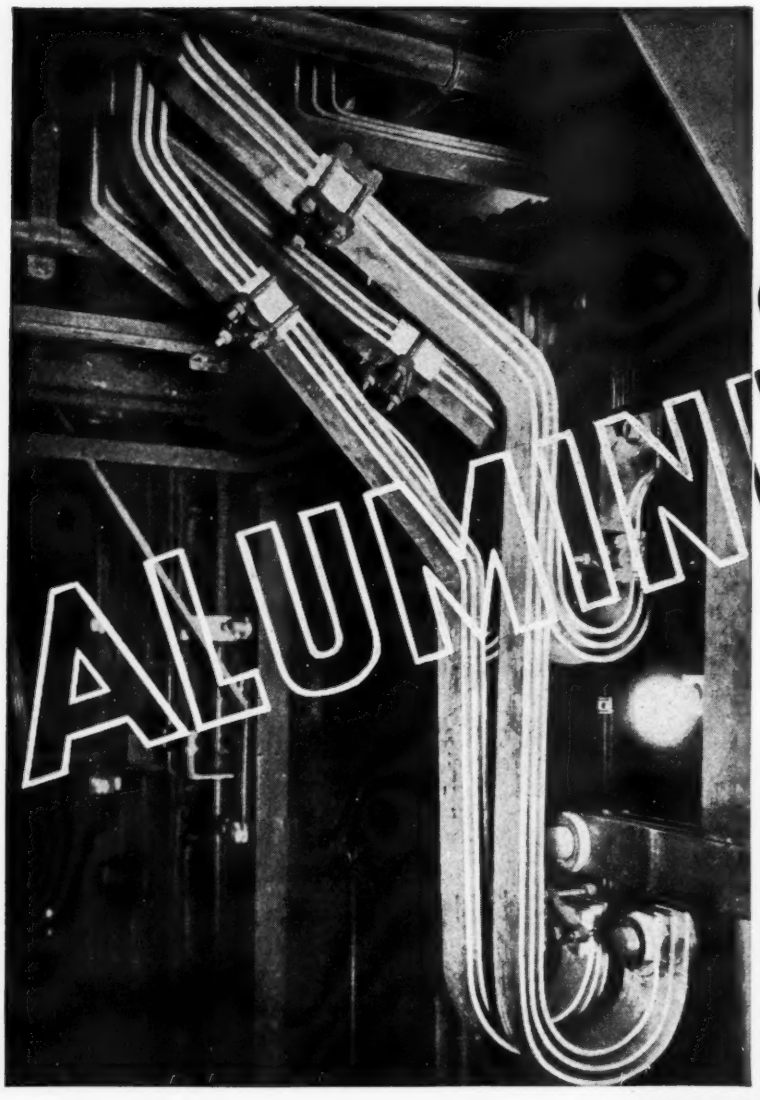
THE RANGE OF 'ENGLISH ELECTRIC' FIRES COMPRISES: PORTABLE—REFLECTOR—INSET—WALL-TYPE SURROUND —MANTEL SURROUND—COAL EFFECT. **PRICES from 8/11.**

★ *Write for Catalogue R78, which illustrates the complete range, to:—*

THE ENGLISH ELECTRIC Co. LTD.

DOMESTIC, HEATING & COOKING APPLIANCE WORKS, BRADFORD

SEATTLE



BUSBARS

Save *Money* IN MATERIAL, *in* INSTALLATION COSTS *and in* MAINTENANCE

THE illustration shows complicated bends in aluminium bars at the Central Telegraph Office Building of the General Post Office. This installation has been in service since 1912, and is still giving every satisfaction.

BA *The* **BRITISH ALUMINIUM** *Co., Ltd.*

Head Office: ADELAIDE HOUSE, KING WILLIAM STREET, LONDON, E.C.4
Telephone: MANSION HOUSE 5561 & 8074 (5 LINES). *Telegrams:* CRYOLITE, BILGATE, LONDON

LONDON WAREHOUSE: 25-29 Pancras Road, N.W.1. BIRMINGHAM, 4: Lawley Street. MANCHESTER, 3: 274 Deansgate. LEEDS, 3: 66 Kirkstall Road. NEWCASTLE-ON-TYNE, 1: Milburn House. GLASGOW, C.2: 113 West Regent Street.

and at New York Montreal Toronto, Calcutta, Sydney and Johannesburg.

E. R. 4.10.35.

The
Electrical Review

VOL. CXVII. OCTOBER 4, 1935. No. 3019.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY. Price 6d.

THE ELECTRICAL REVIEW, DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1.

Telegraphic Address: "AGEEKAY, SEDIST, LONDON." Code, A B C. Telephone No.: Hop 3333 (50 lines).

The "Electrical Review" is the recognised medium of the Electrical Trades and has by far the largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d. Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to ELECTRICAL REVIEW, LTD., and crossed "Lloyds Bank."

Index to Advertisers—See page xl.

Principal Contents:

	PAGE
Appealing to the Public	427
The Insulation Resistance of Hotplates	430
Electrically Equipped London Flats	431
Final Sub-circuits. By H. R. Taunton	432
Distribution Efficiency. By H. Trencham	433
Lighting—Quality and Quantity. By T. N. Riley	434
Current Transformers. By A. Hobson	435
Stimulating Plant Growth. By F. E. Rowland	437
Overhead Line Design. By L. F. Villiers	438
Airport Lighting	439
Corporation and Contractors at Croydon	440
Correspondence: A Neutral Relay; Repair Shop Practice; The Nearly-All-Electric House; A Motor Control Problem	441
New Showrooms at Sutton	442
New Apparatus and Devices	443
Metallurgical Progress. By L. Sanderson	444
Important Submarine Cable Development	445
New Books	445
Why So Many Tariffs? By "Manager"	446
Business and Industrial Notes	447
Electricity Supply	452
Traction	453
Communications	454
Contract Information	455
Notes	456
Our Personal Column	457
Financial Section	458
Patent Specifications	461
New Work for Contractors	462

Appealing to the Public

NOBODY doubts the truth of the claim that a satisfied consumer is an excellent canvasser for electricity. The day has long passed, however, when we were content to know that the leaven was working and to leave it at that. Personal testimony to the value of electricity has, no doubt, been responsible for much of the progress that has taken place during the past decade or two, and its influence naturally increases as the number of users advances. But live propaganda and business-getting efforts of many kinds are as essential as ever.

The electrical industry owes more than it sometimes admits to the organised associated operations that have been made since E.D.A. came into existence, and if impatient questions have been raised in various quarters recently by readers who are wondering when we are going to reap the full advantage of the changes that were made two years ago, this attitude must be regarded as proof that the Association holds a very important position in the industry and is expected to render still greater service; but nobody is happy when matters seem to be delayed, whatever the cause.

It is possible that if the industry generally were better informed regarding work actually in hand criticism and questionings would be less frequent and credit and praise would take their place. A review of a year's work at an annual meeting is useful, but it cannot have the same heartening effect as knowledge of operations in actual progress or in early contemplation.

One of the most useful weapons in the Association's armoury is advertising, and a large part of its revenue is now being devoted to this class of propaganda. It has been urged to increase its commitments in this direction and to reach all classes of the community through Press channels. The President of the Commercial Gas Association said on Monday that since they began to advertise in the newspapers their sales of gas had increased by 50 per cent.!

Though in the past we have criticised certain propaganda details, we have always felt, and are to-day more than ever convinced, that there is room for all kinds of advertising and publicity concerning electricity supply. We are not all influenced by one kind of appeal and the purpose of all advertisements is not the same. Some may be intended for working-class readers who are necessarily small and economical consumers; others are for men engaged in industrial or financial positions with large potentialities as power-users; others for householders who are prepared to spend well upon every kind of electrical convenience and can afford to pay a substantial quarterly supply bill; while yet other advertisements may influence the minds of investors interested in electrical securities.

If this last point seems superfluous or unjustified let it be remembered that one-half of E.D.A.'s revenue is provided by the Central Electricity Board, which is responsible for the issuance of big loans on the London market. Advertising has to be directed to the selling of electricity, the maintenance of the prestige of the industry, and the facilitation of finance.

As we have on previous occasions stressed the importance of electricity supply advertising in the metropolitan area, with its vast population, we are prepared to welcome rather than to criticise the London evening newspaper advertising of recent days. And having been assured that the films are still exercising a satisfactory influence in various parts of the country, notwithstanding all the electrical expert comments on their supposed defects, we feel that there may be plenty of room for the humorous kind of advertising that forms part of this season's general scheme now before the supply industry.

It is becoming plainer every day that, however desirable uniformity of supply and tariffs may be, there can be no uniform method of approach applicable to all places, needs and temperaments. If we wish to sell electricity to everybody we must be prepared to come down from our pedestal and vary our appeal when necessary. It will do us no harm to listen to what others have to say on these matters—to suspend our inside expert critical judgment while we try to occupy the shoes of the, so far, non-electrical person.

Distribution Units

The distribution engineer need not provide so far ahead as does his generation colleague, and he can use superseded plant in other areas. Nevertheless, he cannot, on practical grounds, deal with the situation in a hand-to-mouth manner. The standardisation of "system-increment units," suggested by Mr. H. Trencham in this issue, should help materially towards maintaining, as an average, the point at which operating losses and capital charges per kVA balance. Its feasibility depends upon the elimination of redundant sizes of apparatus, especially of transformers, the inherent reactance of which can be related to the mechanical ability of switchgear to cope with short-circuits on the low-voltage side as well as to its electrical characteristics of current and voltage.

Quality and Quantity

There is abundant evidence that better lighting in industry is usually followed by increased and improved production until a point is reached at which further expenditure on electricity is not paid for by greater output. This can be regarded as the optimum condition only from the narrowest economic standpoint, as it represents merely the minimum at which the operative can perform his task and not the best condition for his eyes over a long period. While luminous intensities much above those now prevailing are desirable, whether in the workshop or in the home, anything approaching the brilliancy of full daylight is not required (and would, indeed, be objectionable) indoors, as Mr. T. N. Riley explains in this issue. There is, however, little danger of the householder overdoing things in an effort to reach even the small fraction of noon-tide splendour that has been suggested by some authorities. On grounds of cost alone he will always expect his eyesight to accommodate itself to the deficiency, but we hope not nearly to the same extent as in the past. Certainly the correct use of light is as important as its intensity, but the two must go together.

SPECIAL DOMESTIC NUMBER

The next issue of

THE ELECTRICAL REVIEW

will be the annual Domestic Special. Developments in all kinds of apparatus for the home will be surveyed and articles by well-known authorities will appear

The Submarine Cable Industry

In spite of the wonderful strides that have taken place in radio-telegraphy the supersession of the submarine cable is taking place quite gradually, for it is stated that there are still a modest 350,000 miles in service throughout the world. Renewal and maintenance of these provides a substantial volume of work, which falls in the main to special manufacturers and contractors in this country. British pioneers in electrical and engineering science, and British finance, seamanship and heroism, gave submarine telegraphy to the world through the medium of British factories, which prospered when there was practically no other electrical industry save land telegraphy. When wireless communication began to prove its practicability there were some who foretold a short life for the cable; others predicted that the two systems would work side by side and in co-operation for many years. A new stage has now been reached, and with the falling-off of new submarine cable contracts has come the necessity for the industry to adjust itself to the altered conditions. Two of the oldest of the several well-known companies responsible for such enterprises have this week registered Submarine Cables, Ltd., with a capital of £220,000, which they hold in equal proportions; the object is to amalgamate the gutta-percha insulated submarine cable parts of their businesses. They are the Telegraph Construction and Maintenance Co. and Siemens Bros. & Co., and they will continue the manufacture in the submarine cable factory of the former at East Greenwich. Both companies, of course, have other large lines of production which, we understand, are in no way affected by the arrangement. The board of the new company will consist of directors from both concerns, and under the chairmanship of Mr. Colin F. Campbell and the managing directorship of Sir Geoffrey Clarke it is intended that the position of the industry shall be strengthened.

Another Cable Development

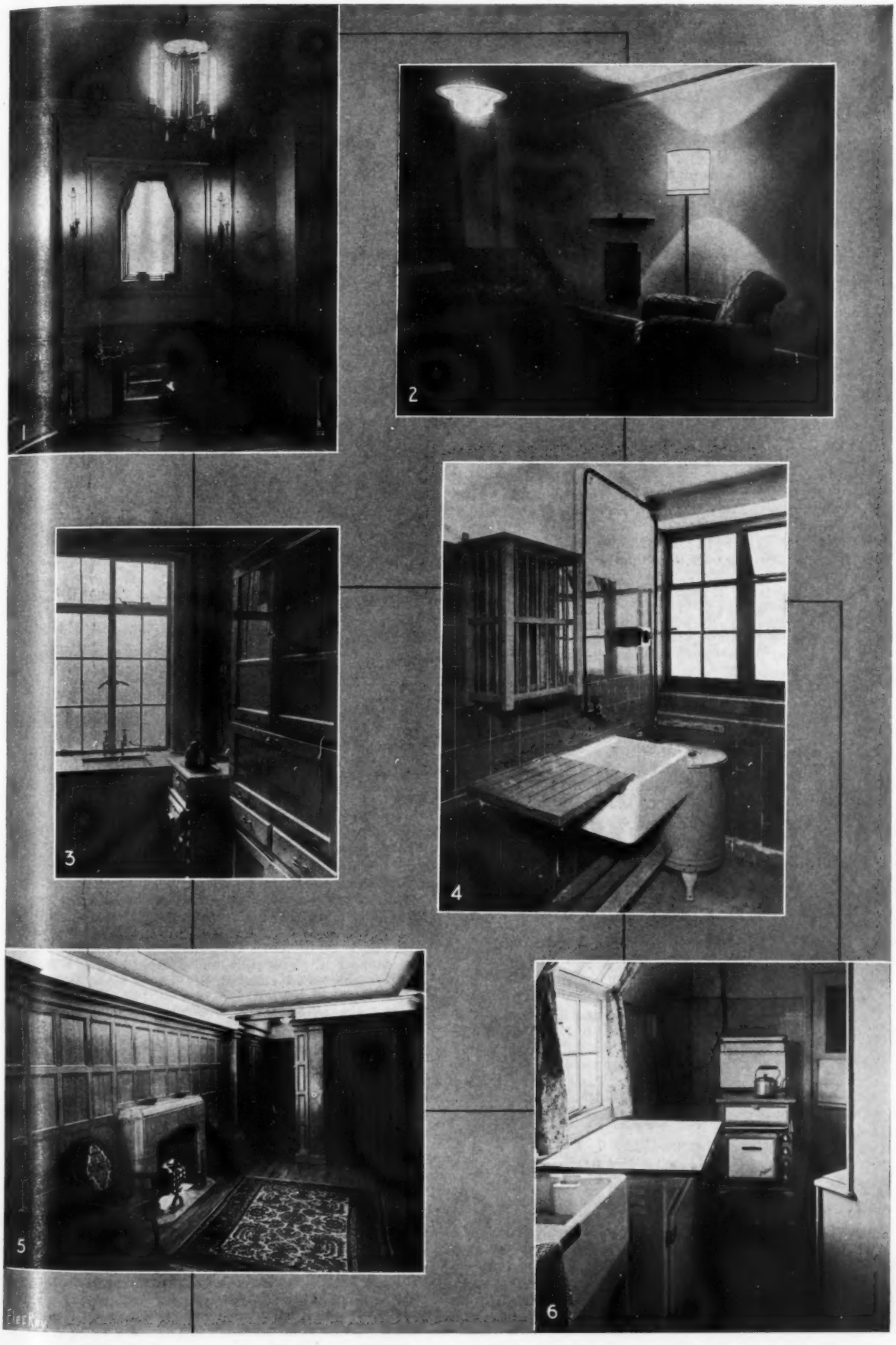
In our issue of July 26th last we described an ingenious device developed by Dr. P. Dunsheath, chief engineer of Henley's, by means of which a lead tube, for sheathing a cable, could be produced continuously in any desired length without stopping the press at the end of a charge and withdrawing the ram for refilling. In the article the formation of a new company to exploit the patent was foreshadowed. This company has now been registered with the title "Henley Extrusion Machine Co., Ltd.," and it is to produce the new machine at a factory at Slough. Sir Montague Hughman and Mr. W. F. Bishop represent Henley's on the board, while the other directors are Mr. W. Travis (Connollys), Mr. P. V. Hunter (Callender's) and Mr. B. Welbourn (British Insulated Cables).

Night Flying

If Croydon does not provide the best site in the world for an air port, any natural deficiencies are more than offset by the arrangements made by the Air Ministry for its illumination. These include warning and wind-direction signs, and, viewed from the air, the effect is to strengthen confidence in the future of night flying, which is to a great extent based upon the ability to take off and land with safety. An "owl's-eye" view indicates also how well an airman can locate his position above a big city by the public lamps, and gives a useful idea of the relative merits of different street-lighting systems, the routes defined by electric-discharge lamps being easily distinguishable by the absence of any mottled effect due to uneven intensities. The schemes in hand for equipping other aerodromes should materially improve the load factor of civil aviation, to which electricity in the form of lighting and radio will make the main contribution.

A German Grid

For ensuring a cheap and reliable supply of electricity, the German Government intends to empower the Minister of Economics to supervise the whole electrical supply industry. The network is to be so constituted, according to *Reuter*, that in the case of big deficiencies of single power sources production may be continued without disturbance. This seems to foreshadow a greater measure of interconnection, on the lines of the British grid. The parallel is extended by the statement of Dr. Schacht, reported in the *Financial Times*, that it is not proposed to substitute a bureaucratic system for personal responsibilities and leadership, all that is required being close co-operation of the companies and municipalities with the Government. There is, however, a veiled warning in Dr. Schacht's reminder that the task must not be endangered by local interests.



How Electricity is Used in Modern London Flats. **(See page 431)**

1, 2 & 3. Entrance hall, dining room and kitchen at Endsleigh Court. 4. Water heating equipment at Wilcove Place. 5 & 6. Entrance hall and kitchen, Ashley Court

The Insulation Resistance of Hotplates

Leakage currents and safety in operation

THE degree of insulation necessary for the safe use of cooking appliances, particularly hotplates, is dealt with in *Elektrotechnik und Maschinenbau* by Dr. A. Velisek, who bases his treatment on a new method of measurement and applies the results to the framing of safety recommendations. The circuit conditions in a hotplate are shown diagrammatically in fig. 1, where R_1', R_2', &c., represent insulation faults at 1, 2, 3, &c., between which there are parts R_1, R_2, &c., of the heating element. As a consequence there is a leakage current

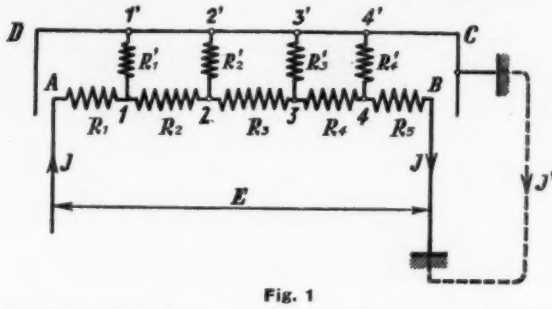


Fig. 1

J' to the earthed frame (point C) and the earthed side of the supply as shown dotted.

Assuming that one leakage path predominates, the circuit is as in fig. 2, which reduces to fig. 3. The resistances R_2, R' are equivalent to $R_e=R'R_2/(R'+R_2)$, hence the supply current $J=E/[R_1+[R'R_2/(R'+R_2)]]$, which reduces to:

$$J=E/R_1+R_2\ (1+F) \quad \text{.....(1),}$$

where F is a correction-term depending on the insulation fault. From the relations $E-E_1=JR_1$ and $E_1=J'R'$, and substituting for J from equation (1), it follows that:

$$J'=E/R'[1-R_1/R_1+R_2\ (1+F)] \quad \text{.....(2).}$$

If the supply connections in figs. 1 and 2 be reversed a leakage current J'* will flow *via* D to earth, R_1, R_2 must be interchanged in equations (1) and (2), instead of $F=R_2^2/[R'(R_1+R_2)+R_1R_2]$ we now have $F^*=R_1^2/[R'(R_1+R_2)+R_1R_2]$. As the hotplate may be connected in either polarity, it is necessary to ascertain whether J' or J'* is the larger. The value of leakage current is greater the higher the voltage E_1 applied to the insulation resistance R', *i.e.*, the nearer the fault is to A, fig. 2, and the further it is from the earthed end of the heating element. The average value of the leakage is half the sum of J' and J'* and:

$$J'+J'^*=E/R'\ (1-F^{**}) \quad \text{.....(3)}$$

where $F^{**}=R_1R_2/[R'(R_1+R_2)+R_1R_2]$.

Owing to the fact that the insulation resistance R' is normally very high compared with R_1, R_2, the correction terms F are generally negligible and the expressions for J, J', J'* and (J'+J'*) reduce to:

$$J=E/R_1+R_2 \quad \text{.....(1a)}$$

$$J'=E/R' \cdot R_2/R_1+R_2 \quad \text{.....(2a)}$$

$$J'^*=E/R' \cdot R_1/R_1+R_2 \quad \text{.....(2a)}$$

$$J'+J'^*=E/R' \quad \text{.....(3a)}$$

In other words, if R' is high enough the line current J is practically unaffected; the leakage currents J', J'* depend on the position of the fault, but the sum (J'+J'*) depends only on the supply voltage and the insulation resistance, practically regardless of the position of the fault. The relation expressed by equation (3a) offers a simple means of determining the insulation resistance of a hotplate from the two leakage currents.

First, however, the numerical value of F** may be investigated. Substituting $R_2=x$ R and $R_1=R-R_2=(1-x)$ R, it is found that the maximum value of F** is when $x=\frac{1}{2}$, *i.e.*, when the fault is at the centre of the element.

Then $F^{**}_{max}=100\ R/(4R'+R)$ per cent. .....(4).

From this it follows that the maximum values of F** in standard 220-V hotplates of 14.5, 18 and 22 cm. (about 5¾, 7⅛ and 8¾ in.) diameter, even with an insulation resistance as low as 1,000 ohms, are only 1.48, 1.0 and 0.67 per cent. respectively. In normal cases the value is much lower, *e.g.*, 0.067 per cent. in an 8¾-in. plate of 0.1 megohm insulation resistance. It therefore follows that the insulation resistance of a hotplate can be determined simply by measuring the leakages currents J', J'* and applying equation (3a). Moreover, the author shows that this method is applicable whatever the number of leakage paths.

The procedure is to connect a sensitive milliammeter between the metal top of the plate and each end of the heating element in turn without switching off the supply. Theoretically, either d.c. or a.c. may be used; actually, subsidiary phenomena seriously affect the results if d.c. be used. Measurements with a.c. are not completely independent of rectifying and capacitative effects, but the method is considered to be the simplest and most consistent available. Readings should be taken continually from the moment of switching on until a steady state is reached, at first every minute and later every five minutes.

Data obtained in this way and plotted as curves of insulation resistance against time show that in a certain case the insulation resistance of a 220-V hotplate fell from 100 megohms when cold to 10 megohms after about 7 min. heating, 0.2 megohm after 23 min., and 0.1 megohm after 60 min., the plate being run empty (without utensil) throughout. When using the plate with a pan containing about 6 pints of water, the insulation resistance fell to a steady value of about 0.8 megohm (eight times its running empty value) in about 30 min., while with a pan containing about 11 lb. of bacon fat at 223°C. (433°F.), the steady insulation resistance was about 0.4 megohm after 30 min. at rated voltage, falling to 30,000 ohms after a further 18 min. at 18 per cent. over-voltage, compared with 3,000 ohms for the empty hotplate similarly over-run.

Thus, the insulation resistance of an empty hotplate may fall to one-thousandth of its cold value, but when a utensil is put on the plate the insulation resistance soon rises to five or ten times the value for the empty plate. In general, the insulation resistance of low-voltage, low-power plates, *e.g.*, 110 V and 800 or 1,200 W, is much more satisfactory than that of high-voltage, high-power appliances.

From investigations at the P.T.R., Berlin, and the Electrical Testing Laboratories, New York, the author deduces that 0.2 mA is about the lower limit of current giving appreciable shock with loose or light contact, and that 6 to 7 mA is the maximum supportable current with good contact. The ideal is thus to limit the leakage current to 0.2 mA, and a leakage of 6 to 7 mA should be regarded as the maximum beyond

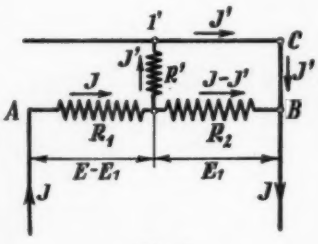


Fig. 2

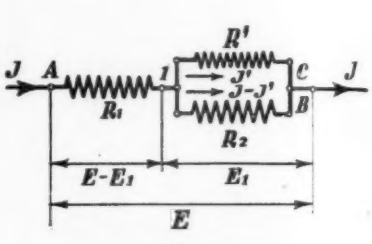


Fig. 3

which there is definite danger. Table 1 shows the values of insulation resistance corresponding to various cases and the conditions under which the requirements can be met. In a cooker with a number of hotplates in use at once the insulation resistance decreases approximately in the same ratio as the number of plates increases, and earthing or other protective measures are essential.

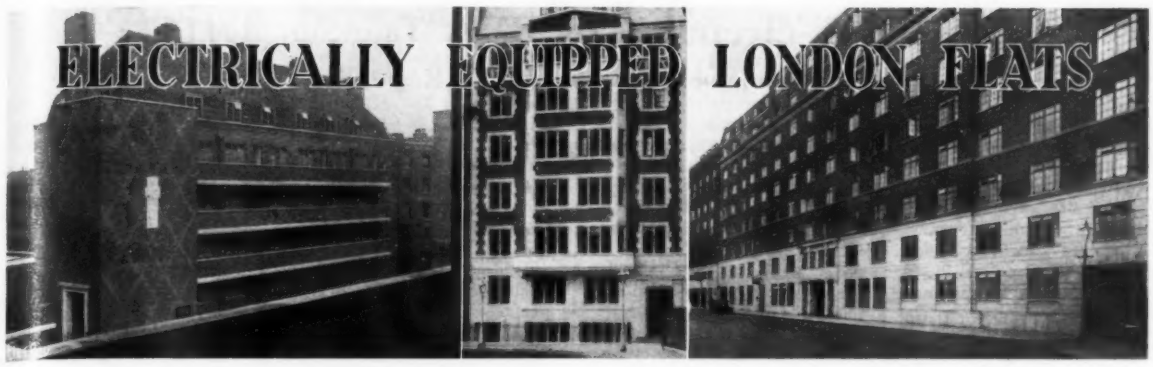
Table 1.—Limiting Insulation Resistances of Hotplates.

Min. insulation in megohms for voltage.			In order that leakage current may not exceed	Condition can be met by hotplate
380	220	110		
1.9	1.1	0.55	0.2 mA (ideal).	In normal service.
—	0.22–0.2	—	1.0 mA.	In severe service (fat, etc.)
—	0.11–0.1	—	2.0 mA (limit for loose contact).	Empty, at rated voltage.
—	0.03	—	7.0 mA (extreme limit).	Empty, at 18% over-voltage.

According to the recommendations of the German R.E.V. the maximum leakage current should not exceed 1.5 mA per connected kW under all conditions of operation, including 40 per cent. overload (18 per cent. excess voltage). On this basis, minimum values of insulation resistance are as in col. 4, Table 2, but the author considers that in the present state of the Austrian electrical industry this requirement may be applied to operation at rated voltage but not at 18 per cent. excess voltage. The recommendation in cols. 5 and 6, Table 2, correspond to 1.22 mA leakage per kW for 220-V hotplates at normal voltage, and to 4.65, 5.42 and 7.22 mA per kW for the three sizes at 260 V (40 per cent. overload).

From the last two columns in Table 2 it will be seen that, on the basis recommended by the author, the total leakage current for a group of three plates of the stated sizes is 4.65

ELECTRICALLY EQUIPPED LONDON FLATS



LARGE blocks of flats are springing up everywhere at such an amazing rate that our readers will probably be interested in the following details of three new London buildings of rather dissimilar types in which electricity is employed very extensively.

After considering comparative figures the St. Marylebone Housing Association, which is responsible for the erection of the working-class flats in Wilcove Place, came to the conclusion that complete electrification was the most economical proposition, and a scheme was devised based on data obtained from a number of similar enterprises in which the average weekly all-in cost was assessed at 3s. 7½d. ("Unit" charge ½d.) In the first section of the flats completed the average weekly cost of the electricity metered for the six months ended March 31st last amounted to 2s. 5¾d. ("unit" charge ¾d.), the average weekly consumption for each flat being 40 kWh.

An all-electric kitchen at Wilcove Place

The building is intended primarily for the rehousing of families in the Salisbury Street-Exeter Street area, and Mr. Louis de Soissons, the architect, has provided in his design 137 flats, each consisting of an entrance hall, living room, kitchen, bathroom and one, two or three bedrooms.

From a h.p. sub-station on the site l.p. cables are taken to each of the five staircases, and three-phase, four-wire rising mains (under the control of the St. Marylebone Electricity Department) have tappings to distribution fuses at each floor level, lateral mains going to the fuel cupboard in each flat. All the switch- and fuse-gear for each flat is mounted in one case and manufactured to the design of the electrical contractors, Messrs. G. W. Franklin & Son, by Messrs. Prentice, Ltd.

The electrical apparatus used (supplied on hire-maintenance by the St. Marylebone Borough Council) consists of a cooker (Jackson or G.E.C.), wash-boiler (Jackson), kettle, iron and one or two fires.

Endsleigh Court, Upper Woburn Place, W.C.1, another block of 181 flats recently completed, is rather a different class of building, since, according to the brochure, "it is especially designed for business and professional people requiring elegance and luxury with economy in a central situation." Eight different styles are available, with one to three rooms in addition to an entrance hall, kitchen and bathroom.

Although the building is centrally heated, each room has a G.E.C. panel fire and there are ample power and light points everywhere as well as a radio point in the living rooms. The all-electric kitchens are equipped with Messrs. Falk, Stadelmann & Co.'s cookers and kettles, all of which are included in the rentals. The electrical installation work was carried out by Messrs. Watson, Marsh & Co., Ltd.

A somewhat smaller building at Ashley Court, Morpeth Terrace, comprising forty-four flats, is electrically equipped for lighting, heating, cooking, refrigeration and vacuum cleaning.

A h.p. supply from the Westminster Electric Supply Corporation, Ltd., is transformed in the building to 400 V, three-phase, four-wire, 400 V being used for power and 230 V for the other services. Arrangements have also been made for a supply from the company's l.p. mains in the event of a failure of the transformer. A four-core, 0.15 sq. in. paper-insulated, lead-covered and armoured cable is run up the building and connected to multiway main distribution boards of 60 A per way on each floor, from which 19/0.032 v.i.r. cables in screwed conduit are taken to each flat, terminating in a 60-A. d.p. ironclad switch-fuse and combined lighting and power distribution fuseboard. From the fuseboard cables in screwed conduit are taken for the various services.

The entrance hall lighting, consisting of tubular lamps forming a continuous strip concealed in the cornice, is extremely even and efficient. The lamps have a consumption of 30 W per foot and are arranged in four sections, the total loading being 1,350 W. No other form of lighting is used in the hall, and the operating cost is only approximately 1d. per hour. The staircase and corridors are illuminated by neat shallow-box-type fittings harmonising with the furnishing scheme. Each flat has a cooker (on hire from the Supply Corporation) and refrigerator, an inset electric fire in the living room, and 15-A wall plugs in the bedrooms. A number of vacuum-cleaner socket outlets are connected to a central Sturtevant vacuum plant in the basement. An automatic push-button lift (Express Lift Co.) is arranged so that it automatically returns to the ground floor.

Vacuum cleaning is done from a central plant at Ashley Court

The tenant obtains electricity for all purposes at ¾d. per kWh, the landlord paying the fixed charge. The Berkeley Electrical Engineering Co., Ltd., carried out the electrical installation.

The Insulation Resistance of Hotplates (*Continued from previous page*)

mA with the plates running empty and at rated voltage. At 40 per cent. overload (260 V), however, the total leakage current amounts to 23.2 mA, which is far beyond the permissible limit. Good earthing or the use of a suitable leakage trip, operating at about 15 mA, is therefore essential.

TABLE 2.—PERMISSIBLE LEAKAGE CURRENTS AND INSULATION RESISTANCES FOR 220-V HOTPLATES.

Plate dia.	Watts.	R.E.V. Basis.		Author's Recommendation.			
		1.5 mA per kW	Insulation resistance (260V × 10^{-3}/mA)	Permissible insulation resistance of empty plate.		Corresponding leakage current.	
				At 260 V.	At 220 V.	At 260 V.	At 220 V.
In.		mA	Megohms	Megohms	Megohms	mA	mA
5½	800	1.2	0.216	0.07	0.225	3.71	0.98
7½	1,200	1.8	0.144	0.04	0.150	6.50	1.47
8½	1,800	2.7	0.007	0.02	0.100	13.00	2.20

Final Sub-circuits. By H. R. Taunton, A.M.I.E.E.

Further points in the I.E.E. Regulations

THE amended definition of a final sub-circuit is "an outgoing circuit connected to *one way on* a distribution fuse-board and intended to supply electrical energy at one or more points to current-using appliances, without the intervention of a further distribution fuse-board. It includes all branches and extensions which are derived from that particular way on the board."

The last sentence is only another way of saying "an arrangement of conductors," and therefore a repetition of the definition of a circuit. The words "and intended . . . fuse-board" are a paraphrase of those of Definition 41 in the 9th Edition; longer, without any gain of clearness or precision. In fact, one might say that the amended definition is no improvement on either the original or the old one, were it not for the words "one way on," italicised above. They are certainly a useful addition, though, curiously, two writers on the amendments in recent issues of the ELECTRICAL REVIEW have selected them for criticism.

Fuses in Parallel

One of them objects that they imply that a contractor might without their restriction use more than one way of a fuse-board for the connection of a final sub-circuit. But that is exactly what he might do. I have seen a cooker point wired with two pairs of 7/.029 in parallel so that one pair could be taken to one way of a board and the other to a second. In other words, one final sub-circuit of perhaps 30 A was "protected" by two pairs of fuses of 15 A each. Worse than that, I have seen a single heavy point wired with a 7-strand cable, four strands of which were connected to one way on the disboard and the other three taken to another.

It is easy to see the idea at the back of the wireman's mind. He doesn't want to go to the expense of a special board for one heavy point, and he shrinks from putting a 30-A fuse in a 15-A carrier; so he conveniently assumes, very likely in ignorance, that two small fuses in parallel are equivalent to one of double the size. The new restriction of "one way" should prevent that particular ingenuity.

The same writer goes on to point out that the restriction does not prevent more than one pair of conductors, forming a final sub-circuit, being connected to one way of a disboard. As he clearly puts it, there is, by definition, no limit to the number of conductors forming a circuit, and the only restriction is on their loading. This answers the objection of the other writer who says two "circuits" looped into the same pair of fuse ways is "contrary to common sense."

Protection of Loops

Provided that the total loadings and number of points connected to them do not exceed the permissible maxima, any number of wires—not "circuits"—may be looped into the same fuse way. There is nothing—except common sense—to prevent a wireman running ten separate loops, one to each point of a final sub-circuit, and bunching them all on a single way of the disboard. It is a very common and a reasonable practice to run one loop to three or four points at one side of a board and another to three or four which happen to be some distance away in another direction, and to connect the two loops at the board.

The only point to be watched is that the two (or possibly more) loops are about equally balanced, or, rather, equally wired, so that the one pair of fuses will efficiently protect each loop. That point is covered adequately by the table on page 16 illustrating Rule 201C, as it makes the size of cable used in any part of a final sub-circuit dependent on that of the fuse protecting it; and the new note to that rule (Clause C) in any case provides for special protection to any smaller-sized loop which may be used.

It is hardly likely that this note—allowing loops of reduced cross-section to be protected by local cut-outs—will, as has been suggested, encourage the abuse of the tree system by the jerry wireman. It would be rarely that he could effect a saving by supplying and fixing a pair of ironclad cut-outs instead of keeping to the same sized cable throughout a run.

Plug Points and Diversity Factor

Rule 201 is one of the most important to the practical contractor, and he will find it an improvement on the old rule 95A, which varied the number of points per circuit according to its total loading. The new rule (Clauses B and C) is simpler and gives him, within reasonable limits, a freer hand. Its greater length is due to new matter. There is a wise restriction on the number of sockets of various sizes allowed on a circuit: one 15 A or three 5 A, as Clause E, subject to a diversity factor "where justified" (Rule 4D, amendment); and ten 2 A, as Clause F, now replaced by Rule 4C, amendment. Special latitude in the number of points allowed in cornice and panel lighting, &c., is given by clause D, which sanctions what has been common practice for a long time, though a breach of the old Rule, 95A, which did not foresee the popularity of such forms of lighting.

A Useful Table

The table on page 16 is a useful one, though for practical purposes it would have been simpler, and therefore better, without the second line. The only effect of that line seems to be that if a contractor wants to use 23/.0076 flex he must protect the circuit by a small circuit-breaker, and not fuses; but that is obviously not the reason for its inclusion. Columns 7 and 8, giving the appropriate sizes of lampholders and sockets, are now, by the new amendments, made permissive, although, curiously enough, Rule 201J, enforcing column 7, still stands—evidently an oversight.

Why, by the way, is "the table on page 16" always lengthened out to "the schedule referred to in clause (C) above"? This is rather typical!

The meaning of Rule 202 seems to be that a light-duty circuit (clock, &c.), properly protected, does not count as an extra point if added to a final sub-curcuit consisting of power sockets only; but that it must be so counted if added to one consisting of lamps, or lamps and sockets. If, then, you have ten 100-W lamps on a circuit (say, 5 A) you may not add an electric clock to it; but if you have three 5-A sockets, fully loaded, on a 15-A circuit, you may. It is not easy to understand the distinction; though, indeed, the point is unimportant in practice.

Note that in Rule 204 the maximum current of a lift motor is stated to include the starting or accelerating current, whereas, according to Rule 4F, amendment, the maximum current of a motor "shall be deemed to be its full-load current."

Rules 205 to 207 are straightforward, and the last is, of course, of major importance. It is rather a pity that by the new amendments distinctive colours for the proper switch wires are no longer compulsory. This will make it easier for the careless wireman to break Rule 207, as he is apt to do with even the "red" rule of thumb to guide him. To be sure, any sensible contractor will still use at least red and black, as a matter of his own convenience.

The words "so placed as to be readily accessible," in Rule 205, will bear pondering. Is the position in which a socket is usually fixed, on the skirting, "readily accessible," particularly when a desk or a bed is put in front of it? There is no real excuse, except unthinking custom, for fixing a lighting socket at that low level, unless perhaps for floor standards; and then it should have a separate switch "readily accessible" without stooping or groping.

Switch-controlled Sockets

That brings us to Rules 208 and 209, dealing with the switch control of sockets. The first is substantially the same as the old rule, but limited to d.c. circuits; the other is new, and allows any number of sockets of any size to be installed without switch control, if the circuit is a.c. It is curious that the Wiring Rules, so stringent in certain matters, such as earthing, should be so tolerant in this. Most responsible contractors will continue, as in the past, to provide all sockets, whether d.c. or a.c., with switch control.

That—convenience—is a consideration with which the Rules are naturally not concerned. On the other hand, to allow the general use of live sockets is to increase the dangers always inherent in live flex. At the best, flex is always the weakest point, the Achilles' heel, of any installation, and nothing which might add to its protection ought to be left to the option of the jerry wireman.

Rule 210, illustrated in the A.S.E.E.'s "Employees' Guide" by a diagram which makes clear its originally rather obscure wording, has been simplified in the new amendments, which, however, deprive it of much of its value by making its observance a matter of judgment. The cheap contractor—if, of course, he has a free hand—will always consider the suggested cut-outs unnecessary.

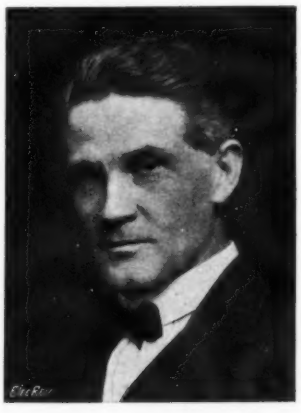
(Note: I suggest, with all diffidence, that future issues of amendments to the Wiring Rules should be printed on one side of the paper only. They could then be cut out and pasted in the appropriate places in the original edition. As it is, they must be kept intact, so that users of the Rules will be apt to overlook them when referring to the text for guidance. The present alternative is to obtain two copies; but as the first is free, one is shy of asking for a second.)

Distribution Efficiency. By H. Trencham, M.Inst.C.E., M.I.E.E.

Its relation to switchgear ratings

IN a paper read before the Institution of Mechanical Engineers in March last year on "The Mechanics of Electrical Switchgear" I forecast that the future would see greater attention paid to the efficiency of distribution systems because the scope therein for effecting saving appeared greater than in generating and transforming plant.

Many writers have pointed out that the ideal of a cheap and abundant supply of electric power throughout the country can be approached only if the various contributing activities function efficiently in combination with each other. Doubtless this thought is behind the action of the Government in appointing a Select Committee to review the organisation of the distribution of electricity in this country. The complete development of the idea of distribution system planning and standardisation on lines which would provide for the needs of all the various classes of load, as and when those needs occur, represents a formidable and many-sided task.



[Elliott & Fry

Mr. H. Trencham is consulting switchgear engineer to the British Thomson-Houston Co., Ltd., and has taken a great deal of interest in switchgear standardisation and research

It is unfortunate that, whereas in many engineering endeavours efficiency of results can be assessed at so much per cent. of a recognised ideal, no such clear-cut measure exists for the appraisal of electric power distribution. It is, nevertheless, obvious that to effect sound comparisons between different schemes a basis of evaluation in engineering terms is highly desirable, and even though we may not see an immediate prospect of rating distribution schemes at x per cent. efficiency our speed of progress will be affected by the simplicity or otherwise with which our studies can be conducted and measured.

In contrasting efficiency in generating and transforming apparatus with efficiency of distribution the essentially different conditions rule out any comparison by which it might be suggested that the engineers responsible for the one class of work are less competent than those dealing with the other.

The problems of each, however, have been coexistent since the inception of electrical developments, and whereas in the one direction we find comparatively close general resemblances in the practice and achievement of all manufacturers the similarities in the other are often more superficial than real. Probably the main reason behind this condition is that competitive manufacture has enforced a measure of engineering co-operation between manufacturers whilst the physical separation of distribution schemes and the special local influences have been a barrier to co-ordinated engineering thought, as well as fostering individuality of expression. The latter, however admirable in detail, becomes very much like confusion when regarded in mass.

A Limited Outlook

This must not be construed as a charge against the distribution engineer, as his scope is confined to the problems of his own limited system, to which problems he must find the best local solutions. He is not interested in, nor is he in a position to determine upon, solutions which would have wide general application; if he were it does not follow that his purchasing power would command the required material or apparatus at an economical price. It seems, therefore, a fair inference that present conditions impose limits to the efficiency which can be attained in electric power distribution at any given location, and only by broadening out or removing those limitations can substantial improvement be expected.

Switchgear, though it is only one of the many factors involved, is an item of considerable importance in the cost and in the operation of a distribution scheme. Some comments on the outstanding points wherein it affects and is affected by system conditions may serve a useful purpose in drawing the problems of distribution into focus.

The variety of apparatus and method which is evident in accomplishing similar ends in electrical distribution leaves no doubt that improvement could be effected. Even given a broadening of existing limitations, such improvement can be brought about only when answers can be found to the questions as to what system arrangements will constitute satisfactory standards and what apparatus will provide the best and cheapest way of meeting the needs of these arrangements.

Variables to be Considered

Before considering this point further it is useful to review the main variables in our distribution systems. Those inherent in existing conditions are: The size and shape of area to be served; the physical relationship to supply source and probably to adjoining areas; the amount of load and its situation, comprising density and daily variation throughout the year; and the probable amount and situation of load extension, its density and variation.

Of these, the third and fourth are subject to the influence of cost of power and convenience of service, but the difficulties and liability to error in forecasting load growth are both cumulatively reduced by decreased cost and increase in flexibility of service.

The principal variations evinced in the evolution of distribution systems are: Voltage, frequency, systems of main connections and interconnections, bus-bar and switching arrangements, methods of protection, normal load ratings, and abnormal current conditions possibly due to faults. The wide diversity in these variables which is found in practice may probably have sprung originally from the impossibility of securing co-ordination in the early stages of a number of separate and broadly concurrent developments.

The resulting condition is that a repeat order for switchgear, except for simple individual pieces of apparatus, is virtually unknown; indeed, the only case which I can call to mind was the replacement of a switchboard sunk by torpedo during the war.

Even though differences may be small in some cases the machinery for providing all the differences must be kept in being, and the effect on costs is permanent. Power companies having reasonably wide scope do effect measures of standardisation by eliminating small differences, but the benefit is relatively small and not to be compared with what could be achieved by attacking the problem the other way round and enforcing the elimination of differences to the maximum extent rationally possible in a scheme of nation-wide application.

Where Standardisation is Possible

Standardisation of voltage and frequency have been sufficiently well aired to justify omitting comment thereon in this article. On the other items something may be said. Systems of main connections and interconnections and bus and switching arrangements have sufficient in common to warrant aiming at two or three typical forms, depending mainly on the bulk of power being handled, which, with their appropriate additions or extensions, should be able to satisfy all requirements.

The G.P.O. gave us a valuable demonstration in regard to system possibilities when it determined upon and carried through its scheme of automatic telephone equipment. The problems are not parallel, but this aspect of distribution has been studied in the United States and on the Continent, and the network schemes evolved leave no doubt in my mind that there is here a definite field for accomplishment.

As regards methods of protection, we have again a good groundwork of common requirement, and it should not need superhuman ingenuity to hit upon a limited number of methods each appropriate to an arrangement of main connections and switching.

The question of normal load ratings presents many points of interest.

One very important feature is the determination of the optimum size of step in system increments. Plant and apparatus must be provided in advance of the anticipated load, and consequently there must always be a proportion of idle capacity. If a system were installed in one big step the idle capacity would be a maximum, and with it would occur a maximum loss by capital charges. At the other extreme we have the hypothetical case of infinitely small system increments applied concurrently with load growth, and our balance between these extreme conditions must be struck having regard to the higher cost per kVA of smaller apparatus and also its lower efficiency.

The standardisation of a few ratings would, by increasing quantities, allow the cost per kVA of a given rating to be lowered or provide a lower loss for a given expenditure.

Another effect of enormous value would be the possibility of building what may be termed "system increment units." With such units of minimum economical rating there would be to hand the most convenient and speedy way of meeting load increments or changes, and errors in load forecasting would have only small practical significance.

Between normal load ratings and abnormal current ratings or breaking capacity there is a relationship which can be turned to good account. By keeping the sizes of the transformers used to appropriate standard ratings their reactance, which is a natural barrier to short-circuit currents, would permit the standardisation of breaking capacity ratings of circuit-breakers in a few sizes only.

Uneconomical Ratings

It has previously been pointed out that the recent advances in circuit-breaking technique have rendered many of the lower breaking capacity ratings mechanically uneconomical. This arises because, minimum dimensions having been settled by considerations of insulation and current-carrying capacity, it is possible, in the space so determined, to obtain breaking capacity of a certain amount. Smaller ratings than this capacity are given only by comparatively trivial lightening of parts, with little saving in cost. It would seem a logical step, therefore, to scrap uneconomical ratings and increase production of the optimum standard sizes.

Referring these various issues to system layout and general distribution, we can imagine the development of a scheme of standard distribution plant units wherein a "ceiling" value of breaking capacity would be determined by standard normal ratings and by appropriate arrangements of distribution plant and connections. These units would be of such a size that space could be found for them at all correct points in the load area and of such design that their application, installation, extension, or removal would be relatively simple and inexpensive.

While a Utopian ideal may not be within our reach, there is everything to be gained by a serious consideration of these ideal conditions in framing and guiding electrical distribution policy.

Lighting—Quality and Quantity. By T. N. Riley, M.Sc., M.I.E.E.

Are we on the right lines?

IT is undisputed that the general standard of artificial lighting in both public and private buildings leaves much to be desired as regards both intensity and distribution. The active campaign for better lighting, now being conducted in the technical Press and elsewhere, lays most emphasis on the necessity for high intensities, and is demanding figures so far beyond normal practice that its supporters appear to be curing starvation by overfeeding. This procedure may be as disastrous in lighting as it would be in bodily nourishment, and may increase rather than decrease the wearing of spectacles which its advocates wish to avoid.

There has hitherto been astonishingly little unbiased investigation into the intensity of artificial illumination which is required in the performance of a task. Several years ago there was a study of the illumination required for type-setting and more recently certain standards have been recommended by the Factory Department of the Home Office in Welfare Pamphlet No. 7, but these are derived from examples of good existing practice rather than from accurate measurements.

In these circumstances two recently published joint reports of the Industrial Health Research Board and the Illumination Research Committee are particularly welcome. One is the first report on the relation between illumination and industrial efficiency, and deals with the effect of size of work. The other one deals with the effect of lighting on efficiency in rough work and supplements the previously published work in connection with type-setting.

The first report shows that for objects subtending a larger angle of vision than five minutes, the efficiency of operation is practically unchanged by intensities greater than three ft.-candles. To appreciate better what this means, a letter of newspaper type, such as is used in the leader columns of *The Times*, subtends an angle of about 15 min. at 15 in. from the eye. Three ft.-candles is therefore adequate illumination for stationary work involving dimensions as small as one-third the size of newspaper type. There are, of course, other factors such as contrast, colour, and rate of movement which may involve still further increases of illumination for good work, and these remain to be dealt with in further reports. The data already obtained, however, cover practically all clerical work.

For Rough Work

In the second report which deals with rough work (tile pressing) in which good lighting is not required to assist visual discrimination, it is shown that an increase in illumination from 1.75 ft.-candles to 3 ft.-candles produced an increase of output of 8 per cent., and an increase to 4 ft.-candles increased the output by 9 per cent. Further increases in illumination produced only a very small further increase in output. The report concludes that an illumination of at least 3 to 4 ft.-candles is desirable for rough work. This intensity is about three times that recommended in a previous report of the Department of Scientific and Industrial Research as the minimum adequate daylight illumination for offices. It is also the provisional standard recommended by the Committee on Factory Lighting as the minimum for fine work, and only a little below that of 5 ft.-candles recommended for very fine work.

In marked contrast with these figures are those of 70 to 150 ft.-candles which have been advocated in many recent articles in the technical Press. The writers argue that since much greater intensities than these are experienced in the open air in daylight hours the human eye is accustomed to them; that it has, indeed, been evolved under such conditions and should always be given such help in seeing. They also quote tests in which the subject has been seated in a special chair with the light under control, and invited to adjust his own light to the best intensity for reading. It is stated that invariably it is adjusted to levels of the order mentioned which are much higher than are commonly experienced indoors.

On the other hand, few or no people adopt any such brilliancies in their homes, and it is not at all certain that, while they may give good perception of detail for a short time, they would not prove extremely trying if the eye were exposed to them for long periods. Such intensities also involve heavy power consumption and are difficult to obtain without objectionable glare. Are they then really necessary in view of the evidence of the impartial tests quoted, and why is it that in short-time tests the subject adjusts his illumination to so high a level?

How the Eye Adapts Itself

There are several possible explanations. In the first place, the response of the eye to changes of light is not linear but logarithmic; that is to say, comparisons of two values depend on their ratios and not on their arithmetical differences. A change of illumination from one to two ft.-candles and a change from 40 to 80 appear to be changes of equal magnitude. At high intensities, therefore, comparatively large steps appear to the eye as quite small changes. It is, therefore, easy to obtain a misleading adjustment in a short-period spot test.

Secondly, the human eye is furnished with means of controlling the amount of light admitted to the retina by varying the size of the pupil. Every railway passenger is familiar with the effect on vision of suddenly entering or emerging from a tunnel. Reading a newspaper while travelling in daylight the pupil of the eye is contracted to near its minimum size to reduce the light reaching the retina as far as possible. On suddenly entering the tunnel the eye remains light-adapted for a moment even if artificial light is on, and the carriage and paper appear dark. Then the pupil slowly opens and after a short interval the light appears quite good, the eye having become adjusted. On emerging from the tunnel, the daylight appears temporarily dazzling until the pupil closes again. Now, if a test is made when the pupil is light-adapted, either because of daylight or of brilliant general lighting in an exhibition hall, far higher readings will be selected than would be the case if the eye had time to become adapted to the new level. In the long run it is more comfortable to have the pupil relaxed because there is muscular strain in holding the diaphragm contracted for long periods at its minimum limit.

A third factor is that an object is not seen primarily by the light which falls upon it, but by the light which is reflected by the object back to the eye. White paper, for example, may reflect 85 per cent. of the light which falls upon it, while a dark grey surface reflects perhaps 10 per cent. and a black surface practically none. A broken-up surface, such as a green grass meadow, may reflect only from 5 per cent. to 8 per cent., and it is clear that the intensity of illumination which the eye finds comfortable under outdoor conditions may be uncomfortably great when dealing with office paper of ten times the reflection factor of outdoor surroundings.

It is not, therefore, fair to argue that because the human

eye has been evolved under the intensities of light prevalent in outdoor conditions, it should have similar intensities indoors. Even if this standpoint is adopted, since early man probably lived largely in forests, where the light was modified by the shade of the trees—or in still darker caves, it is reasonable to assume that the eye has developed under lower intensities than those prevalent in open country.

Harmful and Uneconomical

If these very high intensities cannot be justified physiologically, still less can they be justified economically. To obtain an average intensity of 100 ft.-candles in a room 20 ft. square would require about 5 kW of direct lighting, and 8 kW of indirect lighting, an amount of power which would make the room uncomfortably hot, would require special ventilating arrangements and would be beyond the means of all except millionaires. It is, of course, possible to get such intensities economically by a concentrated local light; but the eye is then subject to the strain of repeated adjustment from the brilliant page to a relatively dark background.

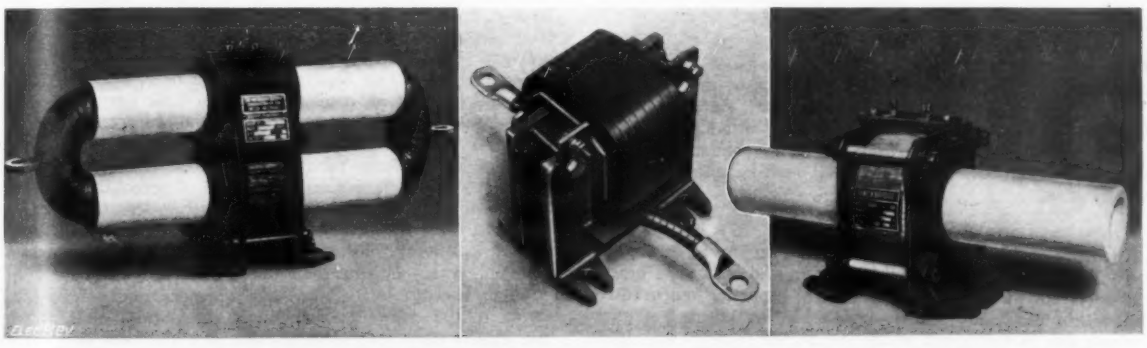
One of the most important factors in daylight illumination is absence of glare from a brilliant source and absence of sharp contrast in intensities. I would suggest, therefore, that it would be in the public interest to direct a campaign not so much to the adoption of excessive intensities as to lighting from large sources of low intrinsic brilliancy, i.e., to the extensive adoption of indirect and architectural lighting from hidden sources. It is true that this will take more power than direct lighting, but it will take far less power than that required for the abnormal intensities which have been advocated. Is it not rather quality of light which is needed, and not excessive quantity?

Current Transformers. By A. Hobson, B.Sc.Tech.

Considerations of reliability

A CURRENT transformer, being connected directly in series with the line, thus forming part of the main conductor, is right in the path of any voltage or current surge, and some of the most costly system shutdowns of recent times have been due to current transformer failures. It cannot be too strongly emphasised that current transformers should be designed and built with these onerous conditions always in mind.

If the secondary winding is open-circuited while current is flowing in the primary a dangerous voltage occurs across the secondary terminals. Normally the primary ampere-turns are almost exactly balanced by the secondary ampere-turns and only the vectorial difference between them is available for magnetising the core. When the secondary is open-circuited the secondary ampere-turns drop to zero, and consequently the whole of the primary current is utilised in core magnetisation. The flux density therefore rises, the core becomes saturated, and a sufficient voltage builds up across the primary to force the line current through. It is this voltage multiplied by the turns ratio which is reproduced at the secondary terminals.



Three types of current transformer.—Left: Wound primary, "trombone" pattern. Centre: Wound primary, with former-wound coils. Right: Through-type, with insulation suitable for slipping over conductor

The r.m.s. value of the open-circuit voltage is not usually very high, since the number of secondary turns and the core cross-section are limited. Owing, however, to the practically total saturation of the core this voltage has a high peak.

Where the Voltage Peaks Occur

It may be assumed that the line current has a reasonably sinusoidal wave-form. Since the core will be saturated at a fraction of the line current the flux wave will be flat-topped. The voltage at any point in the wave is proportional to the rate of change of flux, and accordingly along the flat top of the wave the voltage will approach zero. Where the flux passes through the zero line, however, the rate of change of flux is very great, and it is at this point that the voltage peak occurs. The peak will be higher the greater the ampere-turns and core section.

It might at first appear that "Mumetal" cores would give lower peaks than those obtained with silicon-iron, since the former is saturated at 8,000 to 9,000 lines per sq. cm., as against about 20,000 lines for the latter. This, however, is not the case. The height of the peak depends purely on the slope of the flux wave as it passes through zero. As the permeability of "Mumetal" is many times that of silicon-iron the flux at this point changes much more rapidly, and in consequence the peak voltage is higher. This is borne out by tests, oscillograms showing that the "Mumetal" peak is much sharper and higher than the other.

In practice a "Mumetal" transformer would have only a fraction of the ampere-turns and core section of a silicon-iron transformer of the same accuracy, and the open-circuit voltage would accordingly be much reduced. The chief danger to the transformer of this peak is puncture between layers of the secondary winding. The voltage between turns is very rarely great enough to cause trouble, but the inter-layer value may often be as high as 200 V. Consequently, although a current transformer may normally have only one volt across the whole winding, considerable inter-layer insulation is often essential. This voltage cannot be controlled since the designer of the current transformer already keeps the ampere-turns and core section as low as possible compatible with accuracy.

The highest peaks are obtained on the portable precision type of transformer such as is used in test rooms and laboratories, since these invariably have "Mumetal" cores and a large number of ampere-turns. It is a good plan to fit some kind of short-circuiting switch on all instruments of this type, together with a prominent caution notice. I have never heard of anyone being killed by a shock from an open-circuited secondary, but some very nasty "kicks" can be obtained. The shorting switch enables alterations to be made to the secondary while primary current is flowing.

It has often been stated that the accuracy of current transformers is affected after they have had their secondary windings open-circuited, due to the total saturation of the core causing a change in the magnetic properties of the iron. My experience has been definitely that such is not the case. I have carried out tests on a number of transformers of different types with both silicon-iron and "Mumetal" cores. Large values of a.c. and d.c. were passed through the primary windings for hours at a time. In every case the subsequent tests showed that the errors had not changed.

When a voltage transient strikes a power transformer there is a "piling-up" effect of voltage across the end turns of the winding, the magnitude of which depends on the steepness of the oncoming wave front. A current surge, such as the initial peak of a severe line short-circuit, will have a similar effect when its flow is impeded by transformer turns.

Consequently, the standard practice is to give these end turns extra insulation, the importance of which has justified the issue of a special B.S. Specification (No. 422-1931), stating

the amount of insulation and test voltage between end turns in relation to the line voltage and kVA. The small number of turns comprising the primary winding of a current transformer are in precisely the same position with regard to surges as the extreme end turns of a power transformer, and the insulation between turns should consequently be of a high value.

Manufacturers sometimes specify the voltage that their current transformers will stand between turns, but there is no ruling on this point. I think that a good plan would be to reinforce the primary turns according to the specification for power transformers. The specified test voltage between turns is half the line-to-line voltage for ten seconds. The minimum test voltage is fixed at 6,000 V. The test is a type test, and not a routine test designed to be applied to every transformer.

Short-circuit Conditions

Perhaps the most prolific cause of current transformer breakdowns is the abnormally large current which flows when a short-circuit occurs on the system. Such a short-circuit may cause excessive mechanical forces in the primary winding which will burst the coil if sufficiently great. It may heat up the copper until it melts or until the insulation fails through charring.

The tendency of mechanical forces is to push the coil into a circular shape. It follows that the greatest forces occur with long rectangular coils, such as in the " trombone " type. Nevertheless, this type has proved consistently reliable, and hundreds of thousands, made by a dozen different manufacturers, are in use in this country alone, while very few breakdowns have occurred.

I have never seen a " trombone " transformer which has broken down mechanically. The few failures I have encountered have been on transformers wound for primary currents, of about 5 A, where the primary inter-turn insulation has broken down. On that account " trombone " transformers are unsuitable for such low ratios. Each primary turn has to be threaded by hand through both of the long porcelains, and when the number of turns is between 100 and 150 it is difficult to provide adequate inter-turn insulation because of the low space factor. Manufacturers usually list these down to about 20 A, and go lower only when specially requested to do so. The probable explanation of their mechanical strength lies in the very robust clamping arrangement at the centre of the porcelains where the maximum forces are exerted.

As only a small proportion of breakdowns is due to mechanical strain it may be assumed, in general, that if a transformer is safe thermally it will be safe mechanically. This does not necessarily follow, however, since a highly damped transient may have an enormous initial peak which may exceed the mechanical limit, while the remaining peaks will be so much lower that the total heating effect will not be excessive.

Thermal Effects

The heating effect of a short-circuit current can be estimated fairly accurately for any particular case, and a suitable cross-section of conductor allotted which will keep the temperature rise within reasonable limits. This heating effect is almost entirely due to the ohmic watts lost in the primary winding. A little consideration shows that the secondary winding is not subjected to anything like the same current density since, owing to core saturation, it is not possible to force more than from thirty to forty times full-load current through the secondary circuit. A normal winding will withstand such an overload for about half a minute without excessive heating, which is many times longer than the protective gear would take to operate.

An expression for the temperature rise in a winding due to an abnormally large current is deduced below. As we are only dealing with time periods of a few seconds no radiation losses need be assumed.

Given that 1,058 joules are equal to 1 B.th.u., 1,058 W would raise 1 lb. water 1 deg. F. in 1 sec. As the specific heat of copper is 0.0936, $1,058 \times 0.0936$ W would raise 1 lb. copper 1 deg. F. in 1 sec., or $1,058 \times 0.0936 \times 1.8$ W would raise 1 lb. copper 1 deg. C. in 1 sec., so that deg. C. rise per second = W lost per lb. of copper/178. Since W per lb. = (current density in A per sq. in.)$^2 \times 2.09 \times 10^{-6}$, our final result is deg. Centigrade rise per second = (amperes per sq. in.)$^2 \times 1.17 \times 10^{-6}$.

Buyers of current transformers usually state the kVA rupturing capacity of the switchgear in the circuit and its time of operation. From this can be calculated the magnitude and duration of the worst short-circuit current to which the transformers will be subjected.

As an example, take the case of a current transformer in a three-phase 11-kV line, the primary copper section being 0.1 sq. in., the rupturing capacity of the switchgear 250,000 kVA, and its time of operation one second. The line current is 13,160 A, and the current density is 131,600 A per sq. in. Using the expression derived above, the temperature rise in one second is $(131,600)^2 \times 1.17 \times 10^{-6} = 204$ deg. C. per second.

Resistance and Temperature

We have so far assumed that the resistance of the primary winding remains constant during the short-circuit, but, actually, it increases at the rate of 0.4 per cent. per deg. C. The watts lost in the winding are proportional to its resistance, and thus the rate of temperature rise, being in turn proportional to the watts lost, also increases with time. An approximation can be obtained by taking the *average* increase in resistance during the short-circuit and adding this percentage to the temperature rise worked out from the above expression.

Thus, in the example the increase in resistance for a temperature rise of 204 deg. C. would be 204×0.4, or about 80 per cent., and the *average* rise would be half this amount, namely, 40 per cent. Adding 40 per cent. to 204 gives a total temperature rise of 286 deg. C.

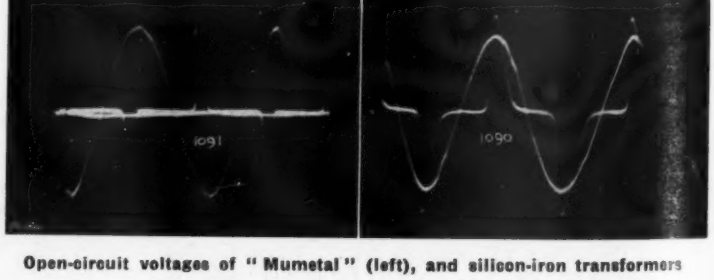
I am of the opinion that 150 deg. C. should be the maximum value allowed, but I believe that many manufacturers work as high as 300 deg. C. Compared with the normal 50 or 60 deg. C. used in the design of machinery these figures at first appear tremendous, but we are dealing with freak conditions which may never arise, and if they do will last for only a second or so.

The temperature rise of the insulation, and not of the copper, is the true criterion of safety. As soon as the maximum temperature is reached the switchgear in the line operates and the current is switched off, so that the primary winding immediately begins to cool at a rapid rate. If the winding has been designed for a maximum temperature of 150 deg. C., the figure I recommend, it is improbable that the insulation even nearest to the copper will be subjected to more than about 120 deg. C., and this only for a minute or so.

Elimination of Weaknesses

The best way of securing safety is to use through-type current transformers wherever possible, as these are immune from troubles due to short-circuit currents and transient voltages. Since the primary winding consists only of a straight conductor there is no tendency for it to become circular, and thus the question of mechanical strain does not arise, while breakdown due to thermal effects could only occur by the fusing of the line conductor forming the primary. Finally, as there is only one turn an inter-turn breakdown is impossible. The feature limiting the use of through-type transformers is the poor performance obtained with low primary currents. In this respect the introduction of " Mumetal " helped considerably by enabling high accuracy to be obtained at much lower currents than was previously possible.

When the use of wound-type transformers is inevitable, owing to the extreme smallness of the normal line current, the ampere-turns may be kept down to a low value by employing a proportion of " Mumetal " in the core. An ample copper cross-section must be allowed in the primary for thermal reasons. Incidentally, increasing the copper section also increases the rigidity of the coil, and hence its mechanical strength, in the wound primary transformer with former-wound coils. This does not, however, apply in the case of the " trombone " pattern, as here a flexible type of conductor must be used to facilitate winding.



Open-circuit voltages of " Mumetal " (left), and silicon-iron transformers

I am indebted to the Hackbridge Electric Construction Co. for the oscillograms and photographs of their current transformers.

Stimulating Plant Growth. By F. E. Rowland, A.M.I.E.E.

Recent research into the effects of irradiation

EXPERIMENTS of great interest have been carried out in various countries on the effect of different types of electric lighting for stimulating plant growth. It has been established that irradiated plants respond to a varying degree, depending on the type of plant, the period of growth, and the season and time of exposure, as well as on the light source employed. Lighting of plants has not been employed commercially to any extent, but the research work which is now in progress should lead to the development of a suitable technique for this purpose.

Standard gasfilled lamps, generally of about 500 W, have been employed in the past, but they have two fundamental drawbacks. Unless the heat is filtered, excessive elongation of the plants may result and the required wattage per sq. ft. is so high that running costs are excessive. Neon discharge tubes also have been used, with which the wattage per sq. ft. of surface irradiated is much lower, while there is the further advantage that the red light, which is characteristic of this source of illumination, results in marked improvement in stimulation of the chlorophyll and absorption of carbonic acid.

Use of Incandescent Lamps

Research work carried out by Mr. Robert B. Withrow in America opens up possibilities for development with small gasfilled lamps which would have been considered impossible a short time ago. Results were obtained with 15-W lamps which were approximately as good as those from higher intensities with 500-W lamps.

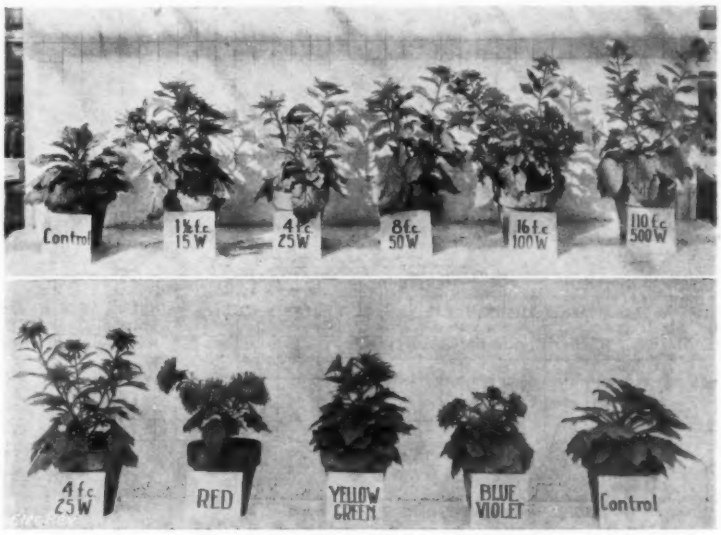
In one experiment with pansies an illumination of 4 ft.-candles for 83 days gave an average number of flowers per plant of 16.2 compared with 1.6 for unlighted plants, whilst asters, with 157 days' treatment, bloomed 33 days earlier. In each case the period of lighting was for ten hours nightly with lamps of from 15 to 500 W. The light intensities were from 1½ to 110 ft.-candles, and the results obtained with 4 and 110 ft.-candles were practically identical. Better-quality flowers were obtained at the lower intensities, although there was no marked difference in stem length or flower ratio. Experiments on stock showed little difference between various degrees of light, but the blooms appeared slightly earlier with higher intensities.

Effects of Different Wavelengths

Investigations into the effect of various wavelengths of light show that while the red end of the spectrum accelerates growth, the blue-violet end generally inhibits development.

The commercial aspect of these experiments may be summarised as follows: A consumption of 1 watt per sq. ft. was needed to maintain ¾ to ½ ft.-candles on the bench, which, applied for ten hours per night for nearly three months, resulted in a consumption of 0.9 kWh per 100 blooms. At 5 cents per kWh the cost per 100 blooms was less than 4½ cents, and the bloom production was increased eight times. During the spring the wholesale price of pansies is $1.0 to $1.50 per 100 blooms. The power consumption with asters under similar conditions was 3.3 kWh per 100 blooms, or 16.5 cents, and during the early summer the wholesale price of asters is as high as $3 per 100 blooms.

Experiments in Germany with incandescent* filament lamps on "Lorraine" begonias and hortensias under different intensities of light, for various periods of time, showed definite commercial gain. The treatment which gave the best results employed electric lighting for a sufficient period to lengthen the natural day to twelve hours. Fifteen hours' lighting also was tried, and, while equally effective, was less economical. The price per kWh was 10 pfg.



Effect of light intensity (top) and wavelengths (bottom) on asters (Heart of France)

"Lorraine" Begonias.

	Auxiliary Lighting.		
	22 foot candles. 15 hours lighting.	12 foot candles. 12 hours lighting.	No lighting.
Time.	60.7 days.	59.3 days.	63.2 days.
	Pfg. per piece.	Pfg. per piece.	Pfg. per piece.
Working cost ...	22	21	23
Lighting cost ...	31	14	—
Total cost... ...	53	35	23
Increased cost ...	30	12	—
Increased revenue	43	33	—
Extra profit ...	13	21	—

Hortensias.

	Auxiliary Lighting.		
	22 foot candles. 15 hours lighting.	12 foot candles. 12 hours lighting.	No lighting.
Time.	74.6 days.	74.4 days.	83.4 days.
	Pfg. per piece.	Pfg. per piece.	Pfg. per piece.
Working cost ...	13	13	15
Lighting cost ...	15	7	—
Total cost... ...	28	20	15
Increased cost ...	13	5	—
Increased revenue	18	23	—
Extra profit ...	5	18	—

Plant irradiation in a greenhouse

In Holland, Dr. J. W. M. Roodenburg is carrying out extensive experiments on the use of neon light for plant irradiation. Green foliage absorbs red light most readily, and under its influence the most rapid formation of carbo-hydrates takes place. The excessive elongation which is sometimes produced in plants illuminated with gasfilled lamps is avoided, because the neon spectrum consists chiefly of red and yellow rays and the heat irradiation, which is characteristic of incandescent lamps, is absent.

As plants do not use the whole spectrum with sunlight, when compensating for a shortage of daylight the same intensity as sunlight (up to 8,000 ft. candles) is not required. The spectroscopic composition of neon light being more suitable for plant culture than that from gasfilled lamps, the requisite intensity of illumination is relatively low (50 to 100

* Kunstliche Beleuchtung im Gewächshaus (K. Vogl). Proceedings of the International Illumination Congress, 1931.

ft. candles for eight hours per night) and only 70 to 100 W per sq. metre is required. In the early experiments high-voltage cold-cathode tubes were used, but recent work has been done with hot-cathode tubes from which higher lighting intensities are obtainable and which operate at normal supply voltages. Correct design of reflectors is important to ensure that full use is made of the light available.

Left: Gloxinia irradiated till the end of February with illumination of 80 ft. candles, 8 hours per night (photographed a month after end of treatment). Centre: Similar plants without irradiation. Right: Cucumber plants compared after that on left had received four weeks' treatment

Early Treatment Most Economical

An intensity of 80 ft.-candles for a period of eight hours from 10 a.m. to 6 p.m. has given good results; whilst illuminating plants in the early stages, before they are planted out, enables a large number to be treated in a small area, which is much more economical than irradiating them later, after they have been planted out.

Young cucumber seedlings, irradiated from the commencement of their growth, showed more rapid development of the first leaf and a darker colour, and at this stage more than 100 seedlings per sq. metre could be treated. They were illuminated until they were planted out in a greenhouse and finally as a result of the treatment a twenty per cent. increase in crop was obtained. With potted plants a 600-W lamp at a distance of 1.25 metres will illuminate approximately 100 plants situated over an area of 6 sq. metres until they are ready for planting out.

Irradiation of begonia seedlings resulted in improving their condition and increasing their resistance to decay from fungi. Cineraria quickly opened their existing buds and under the influence of comparatively weak illumination of 50 ft. candles, were ready for the market two to four weeks earlier. Campanula isophylla (Star of Bethlehem) blossomed earlier and more luxuriantly due to the illumination fostering the formation of bulbs, whilst with gloxinia, although there was not much difference during the period of illumination in the spring, long after illumination had ceased, the plants which had been illuminated bloomed first and had more flowers. Good results were also obtained with strawberries from which heavy crops were gathered.

Experiments on cucumbers and gloxinia (see graph) in England have proved highly successful. Cucumber plants irradiated from the time they were potted out until they were planted out commenced to yield a week earlier than untreated plants, and after eighteen days the yield was over 60 per cent. greater than the control plants. After a short period of irradiation gloxinia seedlings bloomed several weeks earlier than untreated plants.

Overhead Line Design. By L. F. Villiers

FOR the erection of overhead lines in this country the regulations of the Electricity Commissioners must be borne in mind during the design stage. The minimum clearances prescribed for conductors (fig. 1) when the voltage does not exceed 650 d.c. or 325 a.c. are:—Situations inaccessible to vehicular traffic, 15 ft.; public roads, 19 ft.; and other positions, 17 ft. For higher voltages not above 66 kV the minimum is 20 ft.; exceeding 66 kV and not exceeding 110 kV, 21 ft.; exceeding 110 kV and not exceeding 165 kV, 22 ft.; and exceeding 165 kV, 23 ft.

This is a factor of safety of two on the breaking load, assuming a radial thickness of ice covering of $\frac{1}{2}$ in. for high-voltage lines and $\frac{3}{4}$ in. for low voltage lines at a temperature of 22° F. The conductors must be capable of withstanding a wind of 50 m.p.h. at right angles to the line; this is to be taken as equivalent to a wind pressure of 8 lb. per sq. ft. on the whole of the projected area of ice covered lines. The weight of ice is taken at 57 lb. per cu. ft.

For sag calculations the following formula is generally used:—

$$\text{Sag in feet } D = \frac{W L^2}{8T}$$

where W=total loading in lb. per ft. run, and T=horizontal tension at the centre of span in pounds. The inclined tension at the supports is slightly greater and is equal to

$$\sqrt{T^2 + \frac{WL^2}{2}}$$

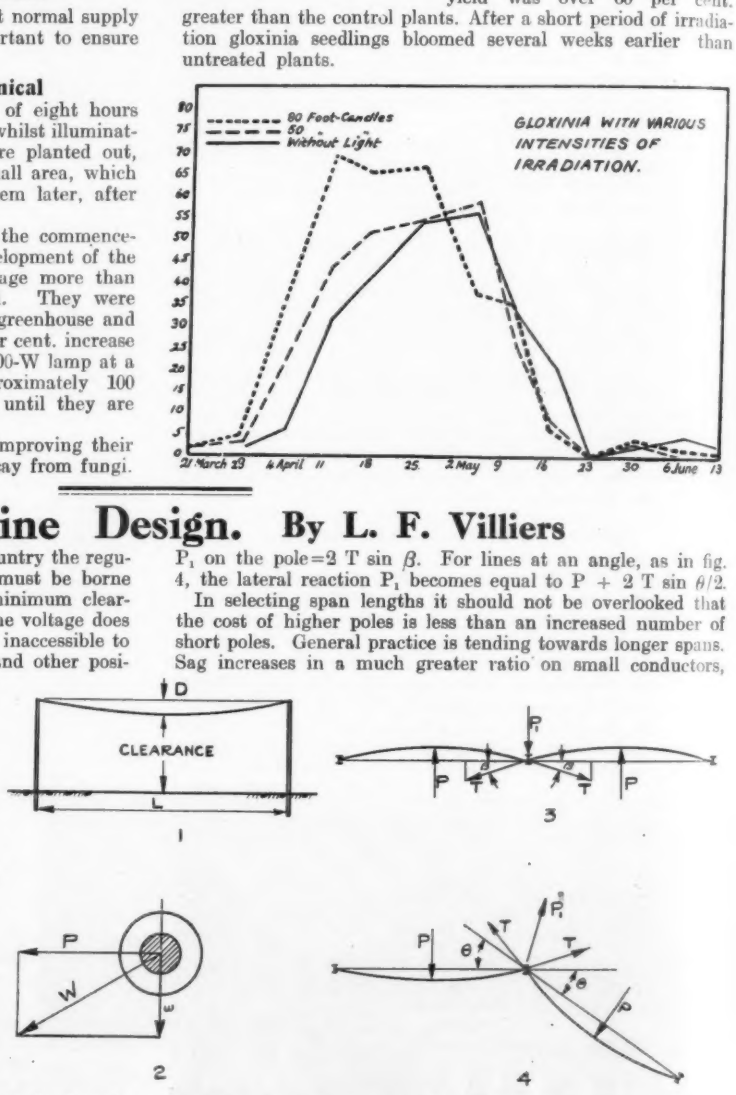
This increase is very small owing to the low inclination for normal spans.

In figure 2 P=wind load in lb. per ft. run. W=total vertical load (*i.e.*, weight of wire and weight of ice).

Then $W = \sqrt{P^2 + W^2}$

In figure 3, assuming horizontal loading, the lateral reaction P_1 on the pole=2 T sin β. For lines at an angle, as in fig. 4, the lateral reaction P_1 becomes equal to P + 2 T sin $\theta/2$.

In selecting span lengths it should not be overlooked that the cost of higher poles is less than an increased number of short poles. General practice is tending towards longer spans. Sag increases in a much greater ratio on small conductors, whereas wind pressure is only slightly increased on larger ones. Longer spans also reduce the number of insulators and so lessen the risk of failure through faulty insulators.



Small conductors should have a larger horizontal spacing owing to sag. General practice is to allow a spacing equal to the sag. Usually the vertical distance between conductors is taken as 1 ft. per 100 ft. of span. This figure seems on the high side, but conductors cannot always be assumed to be loaded equally. Indeed, the ice loading on a number of conductors may vary considerably. Allowance must also be made for the fact that sags may differ slightly from those calculated.

Airport Lighting

The installation at Croydon Aerodrome

DURING the past few years the Air Ministry has conducted elaborate tests of lighting systems for aerodromes with especial regard to securing safety in landing at night. The freely expressed opinion of its officials is that at the premier airport at Croydon they now have the most efficient installation in the world—far in advance of those on the Continent that we have been invited from time to time to regard as models.

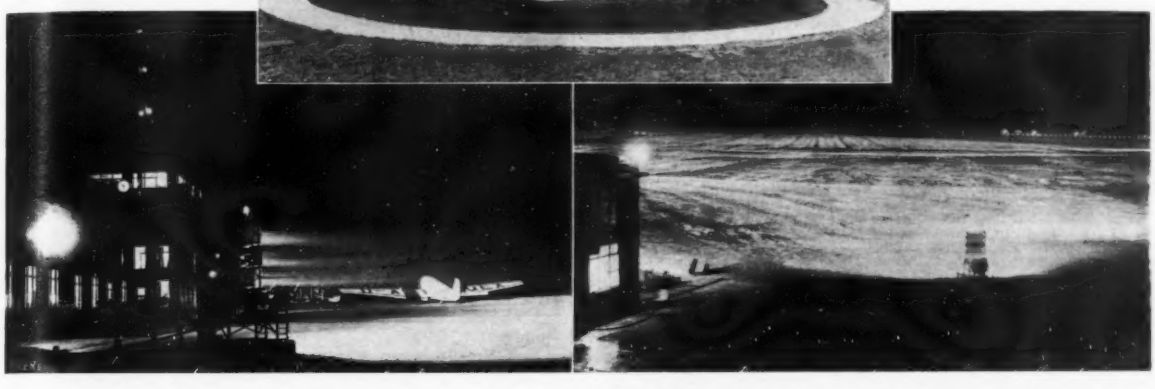
The working of the system from the central control tower ensures speed and accuracy in varying the dispositions of the illumination as may be required, often at frequent intervals. Thus, aeroplanes have to land and take off towards the direction from which the wind is blowing. The two appropriate lighting units can be selected from the ring of eight fixed floodlights round the landing area and immediately switched on when a plane arrives to enable the pilot to approach it from behind the projectors without risk of his being dazzled.

Each floodlight (rated at 6 kW) is equipped with three rows of two 1,000-W "Osram" lamps and optically worked silvered-glass reflectors of parabolic contour. The horizontal spread of the beam is 150 deg., which illuminates over 4½ million sq. ft. with one million beam candle-power. The vertical divergence is small enough to prevent dazzle upwards. The lamps are fed by a ring-main cable from the three-phase public supply system. The extent of the landing is indicated by orange boundary lights spaced at 100 yds. These operate on the constant potential series system, a transformer housed beneath each lamp giving 6.6 V at its terminals. The high-voltage apparatus is above ground, so collision between an aeroplane and a boundary light would not result in shock or fire; neither would failure of one light interfere with the working of any of the others. The globe is mounted on a 2½-ft. stem at the base of which is a weak link which breaks on the impact of collision.

Neon tubes in the form of a truncated cone on a metal framework constitute the aerodrome beacon which flashes its signature in the morse code. On a clear night this signal can be seen over sixty miles away, but owing to the low intrinsic brilliancy of the large area of the light source it does not dazzle the pilots. The red glow on haze makes it readily recognisable when visibility is poor.

The exact direction of the wind at night is shown by an illuminated wind indicator. This is a T-shaped structure 20 ft. long with a 20-ft. cross piece mounted horizontally on a pivot. The upper surface is painted white and is equipped with forty 15-W lamps spaced 15 ft. apart under weatherproof clear-cover glasses. A streamlined vane beneath the tail of the tee keeps the indicator pointing into wind without hunting. Preliminary investigations had shown that size and shape affected considerably the visibility of the indicator and that small lamps at intervals gave a better indication than a line of tubing.

For ease of landing in foggy weather, a line of neon tubing has been installed in the middle of the aerodrome. Each of the twelve sections into which it is divided contains 30 ft. of tubing fixed underground beneath strong glass covers and fed from transformers in pits. The effect is that of a red line of light 1,100 ft. long which is distinguishable when the floodlights tend to become ineffective under certain atmospheric conditions. This system is said to be the only one of its kind in the world.



Above: The illuminated wind-direction indicator. Left: The control tower and a battery of floodlights. Right: A view showing the even nature of the illumination

Many other aerodromes are to have new lighting installations. The General Electric Co., Ltd., which has supplied the equipment described above, has recently had orders in connection with Brighton, Bristol, Cardiff, Gravesend, Gatwick, Liverpool, Leeds and Southampton. The company has also entered into a contract with the Indian Stores Department for the complete lighting of twelve aerodromes over a span of 2,800 miles on the air route across India between Karachi and Rangoon.

The Fabrication of Electrical Machinery. By "Designer"

MANY manufacturers use fabricated parts in order to speed up deliveries of electrical machines, and the results obtained are in many cases definitely in its favour. There are, however, instances where the method is unsuitable.

Fabrication of machinery parts started in the United States twelve years ago, when good iron moulders were scarce and consequently labour charges were high. The percentage of failures in castings of a special nature also put up the machine price, and it was found that steel would serve equally as well as cast iron, and that as smaller sections of steel would carry the working flux of the machine its weight would be less and it would cost less to manufacture.

Small Motor Frames

The frames of dynamos and motors of smaller sizes are made from boiler plate rolled into shape and welded at the joint. The feet are welded on, and end brackets are fabricated and welded, with bearing housings machined in them. Some manufacturers fabricate only the shells and use light castings for the end brackets. This, however, is a matter of individual policy, and happens when a manufacturer owns an iron foundry. The parts for the end brackets, when fabricated, are usually cut out by oxy-acetylene cutters.

Feet are arc-welded in position. Fans, especially those for high-speed machines, are now fabricated, and are safer at high speeds than cast radial fans. The blades of steel fans are usually spot welded to the fan runner.

Frame-cooled machines lend themselves particularly to fabrication, as the mould for a cast-iron machine is intricate and one blow-hole or fault may ruin the whole casting. The complicated air ports in such machines can be spot welded.

For marine-type motors the cost and weight factors are of paramount importance. Most marine electrical gear is to-day sold at very low prices, and the manufacturer who desires to save something on his costs in this class of work

has to resort to fabrication. Weight on board ship must be cut down to the minimum and, here again, the steel type of machine scores. One of the reasons why electrical- has taken the place of steam-operated gear is that it is much lighter per horse-power installed, but reliability cannot be sacrificed for lightness. Similar considerations apply to machines for export, the weight of which must be kept low to avoid high Customs duties. Damage in transit is less likely to occur with a fabricated steel machine than with one with a frame of cast iron.

Effects of Vibration

If vibration is likely to be set up in service the welded construction is more liable to distortion and bending. After welding itself the parts may become distorted due to local heating, and it has been found in practice that the finished article takes quite a long time to settle into its final form. A piece of gear may be quite satisfactory before machining, but after time and money have been spent on it in the machine shop it may be found that the shape has changed.

Small machine air gaps give rise to bending of the frame if the construction is too light in cross-section. A strong magnetic field may pull the rotor on to the stator when a large machine is run with too fine an air gap, and fabrication does not in the least help a poor design.

In a fabricated machine the mass of material heats up more quickly and shell temperatures are usually higher for short periods than in the case of cast machines. For a given armature diameter and length a short time-rated fabricated machine without a fan will not have such a good rating as a cast-iron machine. It is usual to fit a small fan inside a totally enclosed steel-shell machine to stir up the air and dissipate the heat in the machine.

Fabricated d.c. machines have less space for the field coils owing to the diameter of the shell restricting the physical dimensions. The poles are of rectangular construction and it is necessary to step the coils both at front and back to fit into the space available. If the maximum allowable dimensions are exceeded the coils will foul the interpoles (if fitted) or the shell itself. If seatings are machined out in the shell useful steel is cut away and the machine will not give its designed characteristics. This is sometimes done to obviate the stepping of the field coils at the back of the coil. Stepping back a coil is more expensive than winding a parallel-sided coil.

Electrical machinery may be divided into two broad classes, namely, "copper" and "iron." Fabricated machines fall into the former class, and to obtain the output for the same diameter and length of armature the copper in the machine must be put to its fullest use.

Corporation and Contractors at Croydon

CROYDON electrical contractors registered an emphatic protest at Monday evening's meeting of the Croydon Borough Council against the decision of that authority to compete with them by selling apparatus direct to the public in the Corporation showrooms, and by undertaking the wiring for such appliances. This decision, reached at the July meeting of the Council, represents a reversal of the policy which was adopted eight years ago by arrangement with the contractors. The latter, it is stated, were unaware that any change was contemplated and the development took them by surprise. Monday's meeting provided them with their first opportunity to lodge a protest and to state their case. They did so by means of a representative deputation, for which Mr. L. C. Penwill, director of the Electrical Contractors' Association, acted as spokesman.

Mr. Penwill pointed out that the contractors had not had an opportunity to express their views on a subject which was of vital importance to them. The Council's decision in July had reversed a policy which had been agreed between the Council and the contractors and had operated successfully for eight years. Under that arrangement contractors were allowed to stock the showroom of the Corporation, subject to the approval of the borough electrical engineer. It had been complained that the Council's Electricity Department was not free to stock its own showroom or to demonstrate or recommend to the public what it might regard as the most suitable type of apparatus. If the appliances in the showroom were not what the Corporation desired, it was within its power to make an adjustment. Yet not once during the eight years had any complaint been made as to the sufficiency or suitability of the apparatus.

The contractors were with the Corporation in wanting to take every possible step to secure the maximum development in the use of electricity. There were estimated to be 46,429 householders or potential consumers in the borough, and of that number 42,223 had a supply. Bearing in mind the fact that the Corporation had no canvassers to secure that load, great credit was due to the contractors for assisting to bring the undertaking to its present position.

Contractors Cannot Compete

It had been established that the increase in the consumption of electricity which could take place in residential districts was among domestic consumers. So many already had electric light that the maximum possible extension would be in the nature of current consuming devices such as cookers. But with such favourable hire terms as the Corporation offered, contractors could not sell that type of apparatus, nor would they now have the chance of carrying out the work of installation.

The protest of the contractors had the backing of the Croydon Chamber of Commerce, which also sent a deputation. The president, Mr. George Holliday, who was spokesman, contended that members of the Council did not have the full facts before them when they voted in July. Neither the Chamber nor the contractors had any idea that a change was contemplated in the existing system, he said. No suggestions were put forward by the Electricity Committee and its proposals were not discussed with the other parties involved.

There were nearly thirty registered contractors in Croydon, many of whom employed considerable labour. During the past few years they had brought many more customers to the Corporation's Electricity Department than the Department had brought to them. The shopping public of Croydon had £25,000 worth of electrical stock, excluding wireless goods, from which to choose. The service proposed by the Council was already amply provided. It would mean that the electrical contractors and the electrical shops, businesses built up in good faith on the basis of the 1927 arrangement, were to be left in the lurch after having worked to help the Department. The decision of the Council, contended Mr. Holliday, was a direct step to municipal trading, which the Council had always avoided in the past.

The Chairman's Reply

Questions were put to the two speakers by Coun. A. L. Boddington, chairman of the Electricity Committee. He asked Mr. Holliday whether he knew that the actual value of stock at the showroom at the beginning of the month was only £509, which was not a large sum. Mr. Holliday agreed that compared with the cost of the rest of the stock in Croydon available to consumers it was not. But if that were so why should the Corporation enter into municipal trading?

Coun. Boddington asked Mr. Penwill if he was not aware that it was not proposed by the committee to interfere in any way with any payments to contractors in connection with the hire-purchase wiring of houses, with the assisted wiring of houses, or with the installation of hired apparatus where the introduction came from a contractor.

Mr. Penwill said that he recognised that the Corporation proposed to set up an installation department to wire any apparatus obtained from the showroom and to sell directly to the public from the showroom. Coun. Boddington pointed out that the total sales from the showroom during the last year amounted only to £1,073. The Corporation's commission amounted to £54. Mr. Penwill retorted that the Corporation had been using the showroom as it legitimately should be used —for demonstration purposes. The matter was of serious importance to contractors because the greatest potentiality for extension of electricity consumption was the supply to and use by private consumers of heavy current consuming devices. As the Corporation let out that apparatus at really uncommercial hire terms, so far as the capital cost was concerned, the public would hire it from the Corporation instead of purchasing it from the contractor. The contractor agreed with this, but he objected to the fact that the Corporation would carry out the whole of the wiring work, unless the hire of the apparatus was introduced by the contractor.

Coun. H. T. Muggeridge reminded Mr. Penwill that nothing would be sold in the showroom at less than list price. Mr. Penwill said that the law provided that no municipality should do so. But the one who could afford to lavish the most money on a sale sold his product. Municipalities had a monopoly revenue on which to draw for expenses.

At the suggestion of the Mayor (Ald. J. Trumble) it was decided to refer the matter to the Electricity Committee for a further report. It will be considered by the Council again at its next meeting.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

A Neutral Relay

Mr. T. C. Gilbert, commenting in your issue of September 27*th* on my article describing the "neutral relay," points out that an earth-leakage trip can be actuated with 0.5 VA and objects to my reference to 2 VA which was quoted as an example, *viz.*, that if 2 VA is required to trip a switch it is preferable to trip with 200 mA at 10 V than 30 mA, if the small current involves a 66-V potential between apparatus and earth. Obviously much depends upon the resistance of the earth circuit, but a 30-mA trip even with a low earth resistance involves a fairly high voltage.

The neutral relay does not depend on a circuit through earth but through the low-resistance neutral conductor; therefore the apparatus-earth voltage can be kept at a minimum while ample energising current can be employed in the apparatus trip gear. With this arrangement I am sure Mr. Gilbert will agree, since low-voltage operation prevents risk from shock.

I have made earth-leakage switches of conventional type which will open a 50-A circuit with 8 mA, about 18 V being required to trip the switch directly against an earth resistance of 2,000 ohms, which is even better than the figures quoted by Mr. Gilbert. I mention this detail to show that the neutral relay does not rival the standard type; each has its application, and the resistance of the soil circuit and its seasonal variations is the deciding factor.

Small tripping energy implies a high earth resistance. Now, it can be demonstrated experimentally that a very small leakage current—less than is required to operate a sensitive trip device—can rapidly build up a high resistance in its own path until even with a high applied voltage it is impossible to actuate the trip of the protective switch. This explains the reason for developing the neutral relay after completing a very sensitive leakage trip on conventional lines.

There are certain districts, such as North Wales, where the "earth" consists practically of slate; in dry seasons the earth resistance can reach very high values between a transformer earth plate and a farm on low lying ground. Lines at 3,300 V have fallen and remained alive when in contact with the ground in spite of the use of sensitive protective relays; this kind of trouble is usually experienced in hilly districts. It is obvious that when sensitive relays fail to function with high-voltage apparatus the risk is still greater with l.v. and the neutral relay is intended to provide a practicable way out of that difficulty.

Mr. Gilbert comments upon the Commissioners' Regulations. I presume he refers to Regulation 4 concerning multiple earthing; if so, permission can be obtained by application to the Commissioners who are just as keen as anybody to prevent danger. The neutral relay is only intended for areas where standard earth-leakage switches are unsuitable.

Liverpool 8, *September 28th.* A. G. Bullen.

Repair Shop Practice

Is it not time that repair-shop procedure was introduced that would enable all contractors to compete on a common basis?

In some shops the faulty stator or armature of a motor is stripped down and completely rewound; but in others the faulty coil of an armature is replaced or that of a stator is shorted out and nothing else is done. A field coil, if faulty, is stripped down to the fault, a new wire is soldered on and the requisite number of turns rewound on the coil. The armature or stator may, or may not, be given a coat of insulating varnish.

If that is the method adopted then the customer's individual repair bills will be small but they will be frequent, as the adjacent coils may have been damaged also and may have had their insulation charred. Moreover, the adjacent coils may be damaged when putting the new one in position.

Any fault of this kind will generally be shown up on the repair shop test bench but the works cost of the job will be increased owing to the need to return the machine to the winding shop for further work to be done on it. If the shop has quoted a firm price with the intention of repairing only the initial faulty coil, a loss will probably be made on that order due to the restripping and rewinding of the adjacent coils.

Even if the repaired part stands up to the works test, there can be no guarantee that the unit will give satisfactory service for any length of time, and though further breakdown may not be due to the repairer, the customer is apt to blame him for the breakdown and next time will go elsewhere.

When a stator or armature is sent to the repair shop it is most satisfactory to all parties to strip down the faulty part and completely rewind it. If the commutator is faulty then it is better to take it off and send to the makers' works for a new one. This will mean a longer delivery time but the machine will not come back to the shop so often.

These points can be made clear to the customer when quoting for the repair. A guarantee can be given for, say, six months, or even one year if the general standard of workmanship will warrant it. Such a practice would mean a more satisfied customer, as he knows that the repairers will stand by their handiwork for a definite period and that he will be relieved from uncertainty.

When estimates for the repair are sent out, a price can be quoted which is definitely related to the horse-power of the machine and this price can be adhered to whatever the make of machine. This price will always show a profit on the repair. No extras are necessary and the customer, even though he pays slightly more for his repair, has the satisfaction of knowing that the work is well done. The life of the motor is now practically equivalent to that of a new machine. A firm delivery date can also be given with reasonable hope of keeping it.

Customers who are unwilling to pay the additional price for the repair lack foresight. They will certainly pay as much in the long run and this they will find if they keep records.

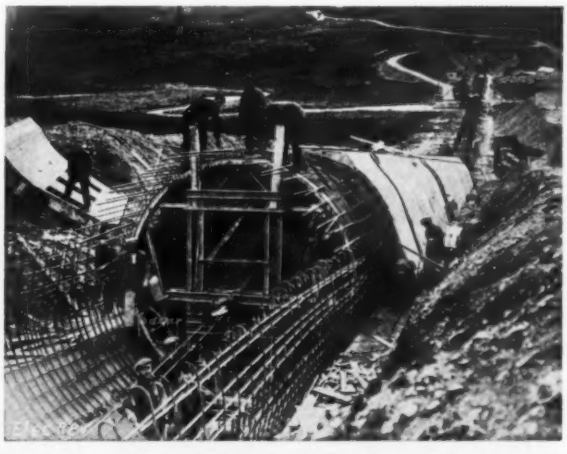
September 30th. Repairer.

The Nearly-all-electric House

Your leader last week on smoke abatement raises the important question: Can an electric substitute for the coal fire be used without an increase in cost? I, as an outsider in relation to the electrical camp, have found that it can be done if the ½d. unit is available. As a result of my experience, others are following in my footsteps. My house is of the £750 type that is being built in large numbers.

I have the ½d. unit all the year round and a standing charge of 16s. per quarter. When starting experiments I had the vague idea that if I could satisfy my womenfolk with an electric fire in the living room which could do the job at ½d. per hour and could be switched off when not in use it might be also an economic success.

My first experiment was with a 2-kW fire, which served



The progress of the Galloway scheme. A reinforced concrete aqueduct being built to connect the Doon and Dough tunnels

very well for intermittent and odd jobs such as it is generally used for, but for the cool of the summer evenings and mornings when 750 W would have served, half heat (1 kW) was too much. With colder weather when 1 kW was just too little, one had no choice but to go over to 2 kW costing 1d. per hour—an uneconomic figure. It also had another serious fault, in that the first switch on gave a roasting heat at 4 in. which, however, was imperceptible at 2 ft. This meant that it would have to be kept burning when not immediately required, and that was fatal to my calculations and the womenfolk resented coming from a warm kitchen or bedroom to a cold room in winter. Eventually I found the essentials of the correct type of fire for my purpose to be: (1) the ½d. unit; (2) a wide-spread radiant beam; (3) elements easily adjustable in wattage to the season of the year. It is now possible, given a correctly shaped reflector, to come down on a freezing cold

morning, switch on and have a meal in comfort even though the air between the user and the fire is still cold.

The wattages required are 750 in the cool of summer evenings and mornings, 1,000 when cold, and 1,250 when freezing. The ability to use 750 W tends to compensate for the use of 1,250 W later and helps towards the average of ¼d. per hour running time. Now my figures show that the living room fire was responsible for 2,263 units during six winter months (182 days), giving 12½ units per day as an average. Some critics may say this was too dear. I had a figure of 3s. 6d. per week for coal to work to.

The man whose circumstances—I do not mean financial ones—are such that he can get through the winter on, say, 2s. 6d. per week for coal, will consume and be satisfied with less electricity than I used. My figures show there were no long periods of switch off. That was because two of the three adults were old and one of them could not be outdoors much in winter. Younger people would be outdoors more and so require less electricity.

The conditions in my case were severe. The house was in an exposed position near the top of a hill on the south coast. Though semi-detached the back looked to the open country. From the front one could draw a line right into the sea two miles away without touching a single intervening house. The roof was unboarded. My womenfolk had been used to plenty of warmth in the house and it was therefore necessary to consume many units if the experiment were to be accepted as successful.

All services were electric except hot water, which was done by a "Sentry" and cost 3s. per week. The total consumption per annum for everything except water was 4,843 units and the cost £13 5s. 9d., or approximately 5s. 1d. per week.

This included liberal use of two more electric fires and a bathroom fire; it was a regular thing to use a bedroom fire ¾ to 1 hour on winter mornings and once or twice later. There were also battery charging, wireless, iron, sweeper, toaster, kettle, cooker, and of course lighting. No special vessels were used for electric cooking and the hot plates were in frequent use.

If, as I expect, the electric fire habit grows the consumption for the purpose will be at least equal to the cooking load and steadier. It will at last make a start on the smoke problem. The substitution of an invisible coke fume for a visible coal smoke does not appear to be the way out. H. C. GOSTICK.

Ewell, *September 28th.*

A Motor Control Problem

In your issue of September 20th information was requested as to the type of starter which could be used for a 1-h.p. motor, other than a direct-on-line contactor starter, in order to comply with Section 7 of the new I.E.E. Regulations, especially that portion of these regulations which calls for the switch to be automatically opened if the supply voltage fails or falls sufficiently to stop the motor.

The direct-on-line starter complies with the Regulations, as the low-volt feature is an inherent part of its design; with any failure of voltage the contactor automatically opens and does not re-make circuit until the voltage is built up to approximately 80 per cent. of the normal. If used with a float switch the motor would be shut down on failure of voltage and restarted with the return of voltage, provided the float switch were in such a position as to be able to close the contactor.

The use of a star-delta contactor equipment does not affect this point in any way, as its no-volt feature again is simply that due to the design of the contactor and other special no-volt features are not normally provided.

It is unusual for supply authorities to insist upon limitation of current when a 1-h.p. motor is thrown direct on the line; in fact, to-day they are willing in most cases to accept motors up to 5 h.p. and in some cases 10 h.p. without such limitation. If the latter is insisted upon, then it would be necessary to use star-delta contactor equipment. BARKER

September 25th.

New Showrooms at Sutton

THE London and Home Counties Joint Electricity Authority's rebuilt premises at 52-54, High Street, Sutton, which were opened on Thursday last week by the Mayor of Sutton and Cheam, Alderman J. G. Kipling, J.P., has a large main showroom about 40 ft. square on the ground floor, with a well-equipped demonstration theatre adjoining capable of seating seventy or eighty persons.

A striking feature of the showrooms is a symbolic window representing the generation and distribution of electricity. The upper floors of the building are occupied by large well-lighted offices for the staff, the basements being used for a sub-station and storerooms.

The whole of the building is heated by a "Dulrae" thermostatically controlled ceiling panel installation carried out by Messrs. Richard Crittall & Co., Ltd. Messrs. Stokes, Ltd., were responsible for the wiring for the lighting.

Welcoming those present at the opening ceremony, County Alderman J. Chuter Ede, chairman of the Authority, said that the work in the Sutton area had been hampered by the inadequacy of the office accommodation and it was the phenomenal growth of the undertaking which had caused the Authority to rebuild the premises. In the short time that the J.E.A. had been operating as a supply undertaking the average price of electricity had been reduced from 3.31d. to 2.48d. per kWh, representing a saving of £134,512 to consumers. Future reductions of prices must depend on the diversity of the uses made of electricity by the domestic consumer.

After formally declaring the premises open the Mayor was presented with an electric radiator by Mr. J. A. Pywell, the architect, on behalf of the Authority. A vote of thanks to the Mayor was proposed by Alderman Dudley Stuart, vice-chairman of the Authority, and seconded by Councillor A. Champness. Mr. A. C. Cramb, director of the British Electrical Development Association, proposed a vote of thanks to the chairman, and this was seconded by Mr. Grieves, president of the local rotary club.

An illustrated brochure tracing the development of the J.E.A. has been prepared in connection with the opening of the showrooms. We dealt at length with the Authority's activities in our issue of September 6th.

Views of the London J.E.A.'s rebuilt premises, High Street, Sutton. Note the symbolic window in the right-hand picture

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Small Cookers

In their range of cookers for the autumn season BRITISH NATIONAL ELECTRICS, LTD., Newarthill, Motherwell, include a small model designed on American lines and known as "No. C.4"; it is intended principally for the Colonial and export markets. It incorporates a balanced drop-down door and two boiling plates 8 in. and 6¾ in. in diameter, loaded at 1,800 and 1,000 W respectively; a 1,800-W 8½ in. by 10 in. griller is also provided and oven heating is by a 2,000-W element. Incidentally, the oven itself measures internally 13¾ in. by 13½ in. by 11½ in. Green and cream or white and French grey porcelain enamel are the standard finishes.

The new "C.2" should be of especial interest to builders of the modern

Two new British National cookers: the "C.4" and "C.2"

type of small house as well as to owners of small houses who are considering cooking by electricity. It is designed to be placed on a table or dresser, being normally supplied without legs. It is otherwise of orthodox design with a side-opening oven door, two circular boiling plates (1,800 and 1,000 W), a griller (1,800 W), and an oven element of 1,600 W. The actual cooking space available is 10¾ in. by 11¼ in. by 11 in.—the specification being practically the same as for the original "C.1" apart from the additional small boiling plate.

Safety Plug and Socket Outlets

Newcomers into the field of domestic plug and socket manufacture are MESSRS. WM. SANDERS & CO. (WEDNESBURY), LTD., Falcon Electrical Works, Wednesbury, who are now introducing a range of safety plugs and sockets in 2-, 5-, and 15-A sizes of both surface and recessed patterns, as well as cast-iron and teak boxes for use with the recessed units. The design is governed by B.S.S. 546, although actually it provides a measure of safety beyond the B.S.I. requirements.

A shield for the live contacts is operated by insertion and withdrawal of the earth pin, and the movement is so adjusted that the socket contacts remain covered until the plug pins have actually entered the holes of the cover. Further, the pins can only be inserted in their correct positions, and so "overhang" is not possible. The pins of the 5- and 15-A plugs are insulated over a distance from the plug body sufficient to ensure that it is impossible to gain contact with the live metal by means of a blade-like article. Self-alignment of the heavy spring-loaded contacts is ensured by the "floating" design, rendering the sockets suitable for use with any make of British Standard three-pin plug.

Sanders "Safety" plug and socket

A soft rubber ring affords a uniform cord grip all round the flexible cable, the grip being maintained effectively even if the ring be cut and inserted after the cable is connected—a time saver in the event of the ring being inadvertently omitted. Simple wiring is afforded by the front-entry contacts by virtue of which mounting blocks are unnecessary. Installed projections of the three sizes are thus only ⅝ in., 1$\frac{3}{32}$ in. and 1$\frac{7}{16}$ in. Entry "knockouts" are provided in the covers and the plain but pleasing exterior should result in freedom from dust traps.

A contribution towards standardisation is that the recessed sockets are as suitable for installing in skirting boards as they are in boxes. They are shallow and self-adjusting to plaster level, so that grid boxes are unnecessary.

An Electric Trouser Presser

A novelty which is likely to be of considerable use to people when away from home is a small portable trouser and tie presser. It consists of two blades containing heating elements and assembled in the form of a "V" so that even when the trousers are being worn the crease can be brought out by slowly moving the presser up and down the crease line, using only slight pressure.

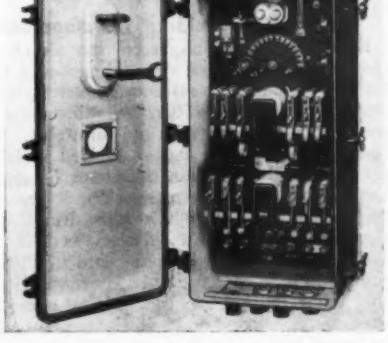
It can also, of course, be used even more effectively when the trousers are hanging from a holder, while its uses extend to pressing ties, coat lapels and pleats in skirts. The metal parts are chromium-plated. It is made by MESSRS. G. M. REID (PROPRIETARY), LTD., 118, Southwark Street, London, S.E.1.

The electric trouser presser in use

D.c. Timing Starters

The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, has adapted a range of d.c. marine-type timing starters for industrial use. Among the advantages claimed are: (1) The motor accelerates at a predetermined rate irrespective of the load, as undue cutting out of the starting resistance on a light load which may be followed by a peak load is prevented; (2) mechanical trouble such as a seized bearing or a jammed fan rotor, causes the resistance to be progressively cut out until tripped by the overload relay. The starters can be supplied for constant- or variable-speed motors up to 20 h.p. at 400 to 500 V, and can be arranged for remote control from push buttons, float switches or pressure switches.

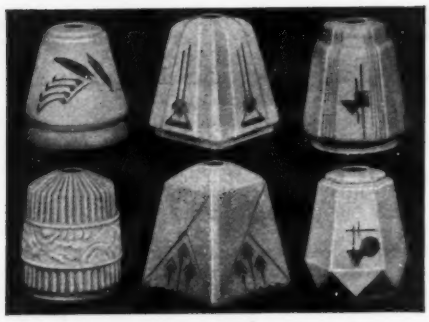
Timing starter for d.c. motors up to 10 h.p., 400/500 V



In the standard form a magnetically operated clock mechanism causes a series of finger contacts to close in succession, thereby cutting out the starting resistance at a predetermined rate, the number of resistance steps being dependent on the horse-power. The rustproof clock gear, which is enclosed in a case, incorporates no springs. The operating coil is protected by a fuse. The finger contacts close with a combined rolling and wiping action; arc chutes and magnetic blowouts are provided. For motors above 10 h.p. the starter contacts are ultimately short-circuited by a line contactor.

At the top of the starter are fitted "stop" and "start" push-buttons and a pilot lampholder. Overload trips are of the adjustable time-limit type, reset by hand, and with no-volt protection. Where required the starter can be disconnected from the supply by a main isolating switch mounted on the outside of the case. The complete assembly (including the starting resistance at the back of the panel) is housed in a watertight welded-steel case, with a removable cast-iron cover. Where shunt regulators are fitted a full field interlock is provided.

A simplified form of the starter has the resistance mounted



Some examples of new "Hailware" glass fittings made by Messrs. Hailwood & Ackroyd, Ltd., Morley, Leeds

on the panel immediately above it. The complete unit is enclosed in a ventilated weatherproof cast-iron case with a drip-proof canopy and a hinged cover. When the starter mechanism is open the motor is automatically isolated.

A Twin-filament Lamp

A new lamp has been introduced by the CRYSTAL TWINLIGHT Co., 46, Kingsway, London, W.C.2, one of the Ismay group of companies. The lamp incorporates two filaments in one bulb, the second filament being brought into use by twisting the cap, in which are one large and two small contacts.

A Steam Trap

MESSRS. HOLDEN & BROOKE, LTD., Sirius Works, Manchester, 12, have recently added to an already comprehensive range a new steam trap known as the "Slik." It is of the bellows type, and is a light compact little unit. There are two patented features of special interest in the internal construction. The first is a swivel movement ensuring good self-centring and therefore tight seating of the stainless steel valve on the renewable stainless steel seat. The second improvement combines the self-centring of the expansion bellows with the provision of a steam-tight joint. The trap works without adjustment between 0 and 150 lb. pressure and will deal with 500 lb. of water per hour.

Metallurgical Progress. By L. Sanderson

Its bearing on the electrical industry

THE past year has seen a number of interesting developments in metals for the electrical industry, and the present article is a summary of these for the benefit of electrical engineers who are too occupied to follow every individual advance. One may begin by mentioning a magnetic alloy, of German origin, which has high initial permeability and is known as "1040." This contains 72 per cent. nickel, 11 per cent. iron, 14 per cent. copper, and 3 per cent. molybdenum.

Japan, having done great service to the radio world with the new nickel-iron-aluminium magnet steels, now comes forward again with a stainless invar material which is not only resistant to the attack of a salt solution, but also possesses a smaller coefficient of expansion under heat than even fused silica. It is thus of great value for instruments and apparatus requiring constant length with varying temperature. Stainless invar has a composition of roughly 54 per cent. cobalt, 36.5 per cent. iron, and 9.5 per cent. chromium. It is highly resistant to corrosion.

With regard to the nickel-iron-aluminium magnet steels invented in Japan, considerable experiment and research have been carried out in our own country on these steels, with the result that they have been tremendously improved; before very long it is expected that these improved materials will be placed on the market for the benefit of the radio, electric meter, miner's lamp and similar industries.

From America come particulars of a new commercial process for the electro-deposition of zinc directly on to steel wire from an acid sulphate bath obtained from the leaching of roasted zinc ore. The process is claimed to be more economical in operation than any of the established galvanising processes. America has also produced a new method of applying copper to steel wire by electro-deposition.

Welding Developments

Electric welding has seen the development of improved electrodes. Electrodes for welding heavy mild steel plate and for the low-alloy high-strength constructional steels are being coated with a composition including certain non-combustible substances that both fuse and form slag. This is for the purpose of safeguarding the arc-welded metal from harmful reactions with the gases in the atmosphere. While this method has been known for some years, it has only recently been applied to plate for high-pressure drums and to the constructional steels referred to. These electrodes are often only inactive defenders of the metal, and in this case they are very similar to it in composition. Alternatively, they include alloys that enter the joint in the welding operation, in which case they are usually of mild steel (assuming a low-alloy steel is to be welded).

A method of projection spot welding is announced. The object of this is to quicken the pace of working, and it is primarily intended to be applied to the welding of pressed parts or articles needing to be united. In pressing the parts to shape them prior to welding, small projections are raised on the surfaces. The electrodes of the welding machine are provided with studs which correspond exactly with the depressions at the back of the projections. During the actual process of welding the projections carry welding current (away from them; the surfaces of the metal are not in contact), and therefore by one sole operation of the machine a considerable number of spot welds are made at once. Great economy in time and money is claimed for the new method.

A silicon steel has been developed specifically for the electrical industry. This has magnetic properties similar to those of a single crystal. Its permeability is very high, and it has extremely low hysteresis losses.

A photo-electric temperature regulator has been invented in connection with electric resistance furnaces, such as are often employed in metallurgical operations. A thermo-element in the furnace actuates a galvanometer, on to the mirror of which a beam of light falls. When the temperature of the furnace rises above the predetermined value the rotation of the galvanometer mirror throws the reflected light ray on to a photo-electric cell which, through the intermediary of a thermionic valve, actuates the control switch and cuts off the current supply. This is a German invention.

Nickel wrought iron is a new product. It contains up to 3.50 per cent. nickel and is now being produced on a commercial scale. The inclusion of nickel in wrought iron raises the tensile strength by 25 per cent., and the yield points by 50 per cent., without any noteworthy effect on ductility. It is claimed that the mechanical characteristics of this new material can also be improved still further by suitable heat-treatment.

Plating Non-metallic Materials

A process has been developed for plating glass, wood, rubber, porcelain, moulded objects, and the like, with silver, nickel, or chrome. The object to be plated is first cleaned and is then given a coating of electrically conductive metal powder with a lower potential than copper. Mixed in an appropriate varnish, it is then plunged into an acid-copper bath, which serves as a binding bath without it being necessary to use an electric current. This galvanic coppering goes on in the usual way, *i.e.*, the object leaving the binding bath is put into a galvanic acid-copper bath in the fashion customary in making electrotype plates.

In cutting tools a considerable departure has been made in connection with form-relieved cutters for various metals and other materials. These are now being manufactured with corrected straight line relief instead of curved relief, a departure from accepted practice which is the subject of numerous patents, and which has been shown to give vastly improved output, freer cutting, absence of rubbing and longer cutter life. The new cutters are made from first-rate, high-speed steel, but cost more than normal cutters.

Other developments concern the application of new materials to productions of the electrical industry. For example, electric food mixers are now being made with bowls of pressed steel chromium-plated instead of china bowls. A galvanised wire is being applied to telephone and telegraph service, the zinc coating of which is applied by the electrolytic instead of the hot dip process; by this method a coating twice or thrice as heavy can be given. The new wire is claimed to be more ductile, to have a better appearance, and to be capable of resisting bending and forming processes without breaking down.

A British Discovery

A new heat-resisting steel is the 25 per cent. chromium steel, while a nickel-copper alloy, of British origin, has been brought out for electrical apparatus in cinema theatres. This alloy has a comparatively high electrical resistance and withstands atmospheric corrosion. It possesses, furthermore, a low temperature coefficient of resistance which signifies that fluctuations in temperature have no effect on the resistance of the element. This attribute has caused it to be employed for arc resistances where any alteration in resistance as the element heats up would lead to variations in the arc's intensity.

Important Submarine Cable Development

THE submarine cable manufacturing sections of the businesses of the Telegraph Construction and Maintenance Co., Ltd., and Siemens Bros. & Co., Ltd., are to be amalgamated.

In a letter to his shareholders, dated September 28th, Mr. Colin F. Campbell, the chairman of the T.C. & M. Co., says that it has been felt for some time that in order to conserve in this country the future of the manufacture of submarine cable having insulation of a plastic material such as gutta percha it is essential to rationalise the industry.

With this object in view an arrangement has been made between the Telegraph Construction & Maintenance Co. and Siemens Brothers & Co. for the amalgamation of their manufacturing interests for this type of cable with effect from October 1st, 1935. A private company, registered under the title of "Submarine Cables, Ltd.," with a capital of £220,000 fully paid, owned in equal shares by the two companies, has been formed and will carry on the manufacture at the submarine cable works of the Telegraph Construction & Maintenance Co. at East Greenwich, which are to be leased to the new company for the purpose.

The directors are fully satisfied that the proposed amalgamation, and the consequent concentration of all submarine cable work of the type referred to above in one factory, will greatly strengthen the position of the industry and will be a decided advantage not only to the shareholders but to the users of submarine cables all over the world.

This amalgamation is a measure of industrial rationalisation of great importance. It means that in future there will be only one submarine cable factory in the British Empire. The board of Submarine Cables, Ltd., is composed as follows.—Mr. Colin F. Campbell, Sir Geoffrey Clarke (managing director), General Sir Hubert Gough, Lord Queenborough, Lord Riverdale, and Dr. H. R. Wright. Mr. Campbell will be the first chairman. It is stated that there is little doubt that under the revised arrangements economies can be effected and that the business will be greatly benefited by concentration in one place, also that submarine cable manufacture, though it has seriously fallen off in recent times, is almost certain to provide sufficient work to keep one factory profitably employed for many years to come.

In a joint statement issued by the two companies the arrangement is said to have taken place as from October 1st and specific reference is made to the departments of the companies engaged in the design, manufacture, supply and laying of submarine cables having insulation of plastic water-resisting material. Siemens Bros., however, will, as heretofore, continue to supply submarine lead-covered cables such as are used for telephone communication across shallow seas, as, for instance, the English Channel and the Irish and North Seas.

The new company has taken over the key men and other members of the staffs of the two companies who have handled the business in the past. All contracts and obligations entered into up to the date of the transfer of the departments involved will be carried out and discharged by the individual companies concerned, unless by agreement with the customer such contracts are transferred to Submarine Cables, Ltd.

The chairmanship of the new company will be taken in rotation by the two parent companies.

A statement covering a number of the points mentioned above has also been issued by Submarine Cables, Ltd.

The details of registration of the new company are as follows:—Nominal capital, £220,000 in £1 shares. Objects: To acquire and amalgamate certain parts or departments of the businesses, works, properties and assets of Siemens Bros. & Co., Ltd., and the Telegraph Construction & Maintenance Co., Ltd.,; to enter into agreements with the said companies; to manufacture, construct, maintain, repair or sell any submarine cables or cable lines for the transmission of telegraphic, telephonic and other messages, speech, music, sounds, signals, pictures, photographs, &c. The subscribers (each with one share) are: Siemens Brothers & Co., Ltd., by H. M. Wright, director, Caxton House, Westminster, S.W.1; Telegraph Construction & Maintenance Co., Ltd., by Sir G. R. Clarke, managing director, 38, Old Broad Street, E.C.2. The first directors (to number not fewer than four or more than ten) are to be appointed by the subscribers. So long as the Siemens Co. and the Telegraph Construction Co. each hold or are beneficially entitled to 49 per cent. of the issued shares, the directors shall before borrowing any moneys from any third party make a written offer to the said two companies to borrow such moneys from them in equal proportions on terms not less favourable to them than those which the directors are willing to accept from any third party. Solicitors: Roney & Co., Orient House, 42/45, New Broad Street, E.C. Registered office: 38, Old Broad Street, E.C.2.

[*Elliott and Fry*

Mr. C. F. Campbell, chairman of Submarine Cables, Ltd., and Sir Geoffrey Clarke, managing director

New Books

Impregnated Paper Insulation. By J. B. WHITEHEAD. Pp. 221. London: Chapman & Hall, Ltd. Price 20s.

This book is issued under the auspices of the Committee on Electrical Insulation of the National Research Council, U.S.A. The author is chairman of the committee and Professor of Electrical Engineering at the Johns Hopkins University, Baltimore, Md. Dr. Whitehead describes this book as a comprehensive survey of his more important researches in this field and the researches described have been carried out in the School of Engineering in his University.

The book contains eight chapters, the general plan being to treat in their order the separate properties of the paper and of the oil, the conditions of impregnation and finally the properties of the assembled product. Each chapter concludes with a comprehensive bibliography, but although there are ninety-five of these references, only three relate to work carried out in Great Britain. To take a few examples only of the useful work already done in this country on parallel lines, surely the researches of Riley & Scott (*I.E.E. Journal*, Vols. 66 and 67), and of Dunsheath (Vol. 73), are worthy of reference. Mr. P. V. Hunter too, in his inaugural address as President of the I.E.E. (Vol. 74), gave a very brief account of the work which engineers in this country were doing and (we suggest with good reason) concluded by expressing hope that "this country may play a part commensurate with its standing in the cable industry of the world."

It is interesting also to compare the papers of Robinson and Brazier on "Breakdown of Cables," published in the July issue of the *Journal*, with chapter 7 of this book entitled "Dielectric Strength and Life," wherein Dr. Whitehead discusses the subject. The book is of the greatest value as a record of what has been done in experimental development and research in the United States, and we commend it to the careful study of all those interested in cable manufacture and maintenance.

Neon Signs. By S. C. MILLER and D. G. FINK. Pp. 288; illus. London: McGraw-Hill Publishing Co., Ltd. Price 18s. net.

The authors are to be complimented on the publication of this very useful book. It is written alike for the manufacturer, the installation firm and the wireman. In the introductory chapter it would add considerably to the interest of the book if mention were made of the early pioneers who were previous to Moore and Claude. The volume is divided into two main parts, fundamental and shop practice. The fundamentals of gas discharges are so clearly put that all electrical engineers can with advantage readily obtain a grasp of the principles of electronic discharge.

A note should be added regarding the average life of a neon tube, and the overall efficiency of the equipment, length of tubing, &c., might be included on page 38. The practical technique is well and fully discussed from all angles, containing many hints on the intricacies of construction, exhausting and auxiliary apparatus. The chapters on sign designing and glass bending are of specific interest, and the one on installation equipment is full of up-to-date data and enlightening information. The book finishes with two appendices; the first gives the American underwriters' requirements for electric signs, and the second gives a complete list of all that is necessary for a one-man plant.

It is a book which we strongly recommend to the attention of all in the electrical industry.

Birmal Technical Data. Birmingham: The Birmingham Aluminium Casting (1903) Co., Ltd. Price 2s. 6d.

This book has been compiled by a committee of the staff of the issuing firm, and takes into account the latest Specifications of the B.S.I. and the Air Ministry. It includes comprehensive information relating to the composition and physical and mechanical properties of seventeen light alloys of aluminium, four of magnesium ("Elektron"), and one of zinc. Each data sheet reviews briefly the characteristics and applications of the alloy referred to. The book should be especially useful to designers.

Practical Radio Communication. By A. R. NILSON and J. L. HORNUNG. Pp. 754; figs. 434. London: McGraw-Hill Publishing Co., Ltd. Price 30s.

This is a new American text-book on radio-communication intended mainly for what is defined as "the practical radio operator-technician." It is a comprehensive treatise upon the whole subject, roughly divided into two parts, dealing respectively with principles and practice.

Only the simplest mathematics is used, and no previous knowledge of electricity is assumed, the first 100 pages being devoted to the principles of electricity, and the last 150 to power-supply apparatus, as rectifiers, dynamo-electric machinery and batteries. This latter section is placed at the end of the book so that the student will be introduced more quickly to the radio portion, having mastered the fundamentals of electricity, while postponing until later the more tedious details of power supply. This arrangement, the authors consider, "offers distinct pedagogical advantages."

Particular attention is given to broadcasting, including information on studio acoustics and apparatus, and control-room equipment and operation; the descriptions of apparatus and arrangements generally, as in other parts of the book, are based on American practice. Ship and aircraft sets and their operation are included, and in general the book aims at being a complete text of the whole field of practical radio-communication based on a theoretical introduction. No space is given to obsolete, or nearly obsolete, apparatus, such as spark and arc sets or to the laws governing radio communication. The book, which is provided with an index, is up-to-date, well produced, and clearly worded.

* * *

Shorter Notices

"Practical Electric Cable Jointing," by W. Maskery. Pp. 120; figs. 35. London: Technical Press, Ltd. Price 5s.

"Wireless Telegraphy Notes for Students," by W. E. Crook. Pp. 189; figs. 228. London: Sir Isaac Pitman & Sons, Ltd. Price 7s. 6d.

"Electrical Measurements in Principle and Practice," by H. C. Turner and E. H. W. Banner. Pp. 354; figs. 219. London: Chapman & Hall, Ltd. Price 15s.

"Mercury Arc Rectifier Practice," by F. C. Orchard. Pp. 224; figs. 106. London: Chapman & Hall, Ltd. Price 15s.

Why So Many Tariffs? By "Manager"

The control of municipal electrical finance

MANAGERS of electricity departments receive a stream of abuse for the variety of their tariffs. At the I.M.E.A. Conventions distinguished engineers sometimes condemn the apparent confusion and the Municipal Treasurers' Association is hovering about with the proposal that they should take over the financial control and put tariffs on a businesslike footing. Their first business would be to put tariffs on an accountancy footing and the second, which they do not proclaim so loudly, would be to bleed the Electricity Departments for the relief of the rates, and, incidentally, for the relief of the treasurers who have a hard time to get in enough money to meet the requirements of the spending departments.

People who support the latter proposal do not seem to understand that it involves keeping the price of electricity at a high level and that it means that electricity consumers pay rates twice over, once as ratepayers and then as consumers. Financial experts seem to imagine that taking money from the electricity department is a kind of magic which produces cash without anyone having to find it!

Meeting Varied Conditions

Why have so many tariffs come into being and why should not one simple and universal tariff be introduced? The reason for the variety which is not recognised, is that electrical men are and have been desperately anxious to sell energy and they are continually finding new outlets for the supply even where these need special rates. When a new load comes along the electrical man busies himself in seeing how he can catch it. This is the secret of the variety of tariffs and it is also the secret of the astonishing success of electricity undertakings as a whole.

One cannot imagine the treasurers tackling the business in that fashion: by their instincts and training they would be content to frame tariffs on an accountancy basis and to tell all consumers that these were the terms and if they did not like them, they could go elsewhere, which many of them would do.

The railways tried the accountancy method. They worked out their costs and made tariffs to cover them and these brought them near to bankruptcy: the roads were full of traffic which used to go by train and the trains were running empty. Then the railway companies woke up and copied electrical methods. They found out the truth of Hopkinson's ideas, that costs consist of fixed and running expenses; that an empty train costs as much to run as a full one; and that it pays to fill the trains. They evolved all sorts of tariffs, night rates, week-end and hikers' rates and a host of others, and they began to look for business and they are now bringing back prosperity by the very means which suffer so much condemnation in the electrical world.

Rigid Standardisation Undesirable

That our present variety of tariffs may be modified now that costs have been standardised is evident, but it must not be done by men whose expert knowledge is entirely divorced from electrical trading. Control by the treasurers would bring us into the condition which was so disastrous to the railways and we do not want that.

Let us consider some reasons for differences in tariffs. Some towns, which have rows of modern houses of a fairly standard type, find the two part tariff based on floor area successful. Why not make it standard throughout the nation? The reason is that many older towns have large old-fashioned five-storey houses with immense rooms and a floor area tariff would be fatal to them. Some towns get along on a 10 per cent. of rateable value fixed charge and people wonder why some other town requires perhaps 20 per cent. Examination of the problem shows that the 10 per cent. town has high assessments and the other one has low ones, and 20 per cent. in poorer towns may produce no more money than 10 per cent. among the aristocrats.

Some towns, where employment is brisk, run slot meters which collect 6d. or 1s. per week fixed charge and a low rate per kWh, but this would be useless where a large number of consumers are on the dole. They would get behind in the fixed charge during the summer months and would go back to gas rather than make up the arrears. In some towns the municipality has built working-class houses where the supply can be given to a large number of houses by cables run under the eaves and electricity is cheap accordingly. Others, in their wisdom, scatter the houses over large areas and insist on the most expensive system of cabling with long services to each house, which increases the cost of supply.

Beware of the Treasurer

The treasurers are working now, and have been working for many years past, to get the electricity departments under their thumb. They have not the training of business men nor have they the time to get hold of the knowledge necessary for the purpose. If they succeed it will mean putting the dead hand of officialism on municipal electricity supply.

The managers of the electricity departments, instead of getting on with their work, will have to spend their time in preparing reports in order to instruct the treasurer, or his assistant, how to run a trading department. When all goes well the treasurer will step into the limelight and take the credit and when things go wrong the electrical man will have to bear the blame.

After a time under this regime electricity departments will be run like the water and rates departments. Tariffs will be standardised and when a new industry comes along and demands special treatment, it will receive a curt letter enclosing a tariff sheet with the intimation that it can take it or leave it.

It was not by these means that our industry became one of the best managed and most energetic businesses in the kingdom with large profits made out of charges which are continually being reduced. The I.M.E.A. will do well to get busy before the blight becomes incurable. Electrical men have never taken credit, as a body, for the wonderful industry which they have created in a very short time, and it is fitting now that they should let the public know what they have done.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

Your Radio Apparatus

When wireless listeners desire to change over, as very many do, from one type and size of apparatus to another, they sometimes defer doing so because of the lack of facilities for disposing of their existing set. This is so, in spite of the fact that there are thousands of potential purchasers. The problem for the trade is to bring the two parties together, and, with a view to making this as easy as possible, our old-established and authoritative contemporary, the *Wireless World*, is introducing a service of small advertisements which will, it is hoped, prove advantageous to user and trader alike. To-day's issue (October 4th) contains full particulars.

The E.I.B.A. Birmingham Dance

The fifth annual dance of the Birmingham and District Centre of the Electrical Industries Benevolent Association will be held on Friday, November 22nd, from 8 p.m. until 1 a.m. at the Magnet Club, Erdington, Birmingham. Hall Pell's Premier Band has been engaged and there will be a number of fascinating side-shows, and competitions, while a running buffet will be provided. A large free car park is available just beside the club. Tickets may be obtained at the price of 3s. 6d. each from the secretary of the Centre, Mr. A. G. Huddleston, General Electric Co., Ltd., Witton Engineering Works, Birmingham.

Electrical Points in the I.F.S. Accounts

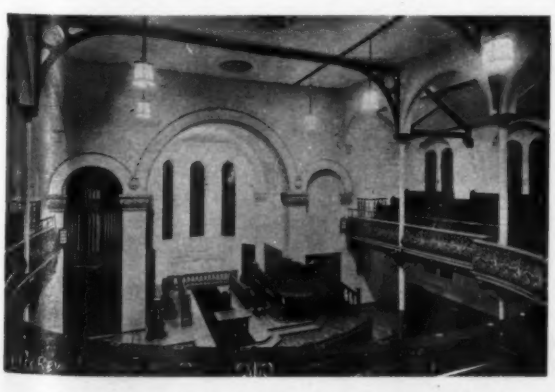
The Irish Free State accounts covering the financial year ended March 31st last show that a substantial revenue was derived from the tariffs on imports of electrical goods during that year. The Customs duty on imports of radio telegraph apparatus was £88,248; on electrical apparatus (unenumerated), £46,359; on electric lamps, £1,602; on electric wire and insulated cable, £3,305; and on power transmission equipment, £1,734. In respect of the broadcasting services in the Free State a revenue of £33,432 was obtained last year from the sale of wireless licences and £13,225 from sponsored wireless programmes. The Exchequer also received £132,450 by way of repayment of advances under the Shannon Electricity Act, 1925, and there was also a sum of £50,000 representing money raised by the creation of public debt to meet capital expenditure under the Telephone Capital Acts of 1924 to 1931. To meet capital expenditure £319,747 was issued under the Electricity Supply Acts of 1927-32, and £75,725 under the Shannon Electricity Act of 1925.

New Plant for Birmingham

Sir Percival Bower, chairman of the Birmingham Corporation Electric Supply Committee, who has visited the works of Messrs. C. A. Parsons & Co., Ltd., Heaton, Newcastle, accompanied by Major Sale, vice-chairman, and Mr. Forrest, chief electrical engineer, stated that a provisional decision had been arrived at to place an order with Messrs. Parsons & Co. for a 50,000-kW turbo-alternator valued at about £150,000. Two turbo-alternators are now under construction by Messrs. Parsons of a value of £350,000.

Church Lighting Installations

Interesting examples of modern church lighting have recently been carried out at the Abbey Road Baptist Church, St. John's Wood, and at St. Margaret's Lee, London, S.E., by Mr. P. D. Morris. The special fitting used in both these installations was designed by the Illuminating Engineering Department of Siemens Electric Lamps and Supplies, Ltd. The



The Abbey Road Baptist Church, St. John's Wood

fitting is built up of a mirror glass reflector in the base, which provides the main or downward illumination in the body of the church; in the top of the fitting provision is made for three lamps of a low wattage to light the roof and walls. It is usual in the majority of churches to dim the lighting during the sermon, and therefore by using this type of fitting with two-way switching the main downward light can be dispensed with when necessary, as sufficient illumination is obtained from the subsidiary top lighting. Easy access is provided to the interior of the fitting; the system employed allows for both hands being free for cleaning and replacing the lamps.

The accompanying illustration shows the Abbey Road Baptist Church, which has fittings equipped with one 300-W lamp for main lighting and three 40-W lamps for upward lighting. The chancel is lighted by troughing and silvered glass reflectors placed behind the two arches.

New Belfast Maternity Hospital

The Belfast Union new Maternity Hospital has accommodation for 113 patients in addition to the necessary staff and the kitchen suite comprises the main kitchen, two sculleries and culinary store, all on the lower ground floor. Electric cooking apparatus, which has been supplied by the Jackson

A general view of the kitchen at the Belfast Maternity Hospital

Electric Stove Co., Ltd., includes an electrically heated range comprising three large ovens over which is mounted a hob carrying ten electrically heated boiling plates. All boiling plates and ovens are separately controlled by their own three-heat switches which, together with fuses and pilot lamps for each circuit, are mounted on a switchboard which is fixed on the wall at the side. A grill toaster with a grill space of 18 in. by 13 in., a hotcupboard measuring 7 ft. by 2 ft. 6 in. by 2 ft. 9 in. high, a 5-gallon water urn having a loading of 3.4 kW, two 15-gallon boiling pans for vegetable boiling being provided with a water jacket and with balanced hinged covers, and two electrically heated steaming ovens for vegetables, fish, &c., are included. Each oven measures 18 in. by 24 in. by 25 in. deep internally and each is fed through its own automatic ball valve tank. All the apparatus is in "de luxe" all-enamelled finish. In addition, there are electrically driven washing machines, a mixing and general purposes machine, and a refrigerator (model SC-50 B.T.H. type).

American Appliance Sales Up

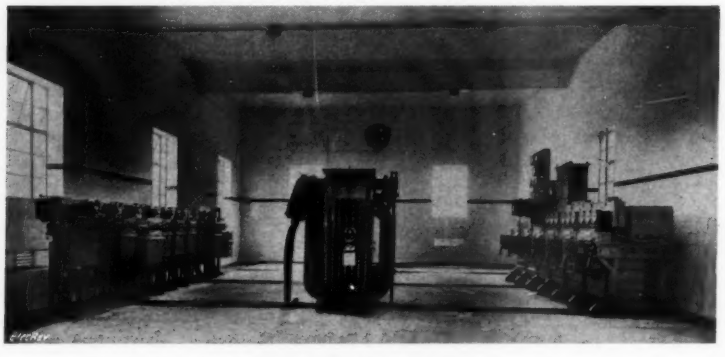
A survey recently made by the *Electrical World* of the activities of more than a hundred American power companies revealed a considerable advance in the sales of domestic appliances during the first half of this year. During the six months these power companies sold 29 per cent. more refrigerators, 68 per cent. more ranges, 82 per cent. more water heaters, 2 per cent. more vacuum cleaners and 15 per cent. more small appliances than in the first half of 1934, but they sold 9 per cent. less clothes washers and 7 per cent. less ironing machines. At the same time the dealers in these territories increased their sales of these appliances by the following percentages: Refrigerators 30, ranges 113, water heaters 107, clothes washers 23, ironing machines 30, vacuum cleaners 13, and small appliances 33. The value of sales by utilities increased by 22 per cent.—from $24,764,193 to $30,349,676, although the number of consumers rose by only 3 per cent.

The Blackburn Electrical Exhibition

An electrical exhibition organised by the Blackburn Corporation electricity undertaking was opened on September 27th at the Blackburn Public Hall. The Mayor (Ald. C. A. Critchley, J.P.), who is also chairman of the Electricity Committee, presided, and said it was many years since Blackburn held its last electrical exhibition, and he hoped the fullest advantage would be taken of this one. There were many distinguished visitors, including Mr. C. G. Morley New (Electricity Commissioner), Mr. P. J. Robinson, chairman of the E.D.A. Council, Mr. C. T. S. Arnott (Central Board), and representatives from neighbouring authorities. Mr. Morley New, who performed the opening ceremony, recalled that the

Department was now in its forty-first year, and that this was only its second exhibition. Experience showed that an occasional well-organised exhibition provided a great stimulus. All sections of the industry were represented. Mr. Robinson said that during the last ten years the electrical industry was the only one in the country which had gone ahead by leaps and bounds. During that period the total generating capacity had increased from 3,500,000 kW to 7,000,000 kW; the output had increased from 4,500 million to 15,000 million kWh; and the number of consumers had risen from 1,356,000 to over 6,250,000. Alderman E. Porter, J.P., vice-chairman of the Electricity Committee, said that the cost of production at Blackburn was among the lowest in the country for a two-shift station. This year, the Department showed a profit of £17,000, while during the past four years, through a reduction of tariffs, they had saved consumers an annual amount of £40,000. Already 3,500 consumers had availed themselves of the assisted wiring scheme. New consumers connected to the mains during the past five years had averaged 2,000 per annum. The energy sold for domestic purposes last year, exclusive of lighting, amounted to over 5,000,000 kWh.

Among the exhibitors were the following:—Corporation Electricity Department; Electrical Association for Women; Refrigerator Distributors, Ltd.; Aidas Electric Co., Ltd.; Ferranti, Ltd.; Electrical Contractors' Association; Mersey Cable Works, Ltd.; Hotpoint Electric Appliance, Co., Ltd.; Benjamin Electric, Ltd.; Bulpitt & Sons, Ltd.; British Thomson-Houston Co., Ltd.; James Stott & Co. (Engineers), Ltd.; Burnley Components, Ltd.; Imperial Chemical Industries, Ltd.; A. Reyrolle & Co., Ltd.; Siemens Electric Lamps & Supplies, Ltd.; Berry's Electric, Ltd.; Falk, Stadelmann & Co., Ltd.; Moffats, Ltd.; Jackson Electric Stove Co., Ltd.; General Electric Co., Ltd.; Revo Electric Co., Ltd.; and the Electric Lamp Manufacturers' Association. In the Lecture Hall there were exhibits by Hanovia, Ltd.; Aron Electricity Meter, Ltd.; British Sangamo Co., Ltd.; the Edison Swan Electric Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Schall and Son, Ltd.; the Central Electricity Board; and an industrial development exhibit by the electricity undertaking. A photograph taken during the opening ceremony is reproduced on page 457.



A model industrial sub-station

The Shipley "Modern Homes" Exhibition

A "Modern Homes" Exhibition was opened at the Victoria Hall, Saltaire, Shipley, by Councillor W. S. Tinsley, J.P., chairman of the Urban District Council, on September 28th. This exhibition is a combined effort of the Gas and Electricity Departments, showing all the latest apparatus and appliances, and illustrating the way a modern house should be run, and it is the first of its kind in this district. The main features of the Electricity Department's display are the model rooms of the "House You Want," comprising sitting room, dining room, kitchen, bathroom and bedroom, and at every point where possible electrical appliances are installed. The sitting room has a very pleasing setting around a Berry's "Haloberry" fire, as supplied to the King's House, together with a pendant fitting with brackets to match, floor standard, table lamp, coffee percolator, radiogram and electric clock. In the dining room, which is set out for a meal, is a "Neolux" pendant with sideboard candle standard, a Berry's "Winchester" fire, hot service waiter, electric toaster, hotplate, fan and electric clock. Adjacent to the dining room is an "all-electric" kitchen, which has been planned by "Modern Washways" of London. This contains a cooker, washing machine, ironer and vacuum cleaner, a refrigerator, inset fire, fan and an electric clock. Next to the kitchen is the bathroom, displaying an electric storage heater, Berry's electric radiator and towel rack, a wall fitted reflector fire, an illuminated shaving mirror and special lighting unit. Adjacent to the bathroom is the bedroom, fitted with a "Mistoberry" fire, fan, tea cabinet, table lamp, dressing table light, electric clock, special ceiling fitting, bed-light and hairdryer. A special feature of this bedroom is the electric fire which can reflect any desired colour to suit the colour scheme of the room. Opposite to these model rooms are four stands displaying all the latest electrical apparatus. One of these stands is an exhibit by Messrs. Arthur English, Ltd., a local firm of electrical contractors, who also provide the musical apparatus and public announcing equipment. At the end of these stands is the Electricity Department's information bureau. Regular cooking demonstrations are being held, together with a programme of E.D.A. talking films.

An Industrial Sub-station

At the new works of the Coventry Swaging Co., Ltd., Canley, Coventry, there is a sub-station of which Mr. C. B. Hammond, chief engineer to the compan,y is particularly proud. The equipment comprises an e.h.p. switchboard consisting of six Switchgear and Cowans internal isolation units of 150,000-kVA rupturing capacity, two B.T.H. transformers, and on the low-voltage side a ten-panel switchboard constructed from S. & C. industrial type pedestal units. Mr. Hammond says that the sub-station was designed to show that industrial electrical gear need not be housed in the darkest, dustiest corner of the works. In this case the company determined to obtain ideal operating conditions for the static electrical plant. This installation is but one of many carried out in the Coventry district by Messrs. Lee Beesley & Co., Ltd., consulting engineers, and Switchgear & Cowans, Ltd., have supplied more than 100 units of switchgear for service in the city.

Street-lighting Problems

The County of London Electric Supply Co., Ltd., has issued an attractive booklet relating to adequate street lighting as an important factor in safety on the road. This is primarily intended to assist members of local authorities in solving their street-lighting problems and contains many excellent illustrations of electric street-lighting installations carried out by the County Company and its associated concerns, together with pictures taken before the installations were carried out, showing the marked improvement in the visibility provided by the modern method.

Orders Recently Booked

The synchronous time system installed in the L.M.S. cross-channel motor vessel *Duke of York* was briefly described some few months ago. A further installation of the Harlandic-Synclock time system is being fitted on board the largest ship launched this year, *i.e.*, the Union Castle Mail Steamship Co.'s *Stirling Castle*. This system was chosen for the *Duke of York* owing to the fact that any of the clocks could be fitted with

A general view of the stands at the Shipley exhibition, and (right) the electric kitchen

a centre seconds hand rigidly interlocked with similar hands on any of the other clocks. With the *Stirling Castle* and her sister ship, the primary consideration leading to the adoption of the Harlandic-Synclock system was the feature whereby all the clocks can be advanced or retarded together by a predetermined amount. Instead of the clocks having to be put on or back perhaps half-an-hour every night, each one of them is driven by a miniature "Synclock" motor, and is thus electrically interlocked with every other clock, and all may be continuously advanced or retarded by an accurately predetermined amount, according to the easterly or westerly travel of the ship. This is automatically effected by regulating the speed of the small alternator which supplies current to the clocks. The clocks are operated in parallel in contradistinction to the series connection. Besides the *Stirling Castle* and her sister ship, each of 25,000 tons, Messrs. Everett, Edgcumbe & Co., who are the sole licensees and manufacturers of the Harlandic-Synclock equipment, have orders for the installation of the system in four other vessels for various owners.

The South London Electric Supply Corporation has decided to equip all its under pavement sub-stations with maximum load indicators. For this purpose 369 Price & Belsham maximum load indicators will be used. The conditions in the sub-stations in which the transformers are installed are rather exceptional as owing to the impossibility of ventilation the temperature at times is as high as 80 deg. C. with a mean temperature of about 50 deg. C., and the atmosphere is extremely humid. In order to ensure maximum accuracy over such a wide temperature range, these indicators are specially calibrated at a mean temperature of 50 deg. C. Owing to the limited space available, they have a foot cast on the back of the case so that they will stand at an angle of 45 deg. on the top of the transformer tank itself and under the pavement cover. This arrangement also has the advantage that the readings can be very easily taken by an observer standing on the pavement.

The Cawnpore Electric Supply Corporation, Ltd., has placed an order with Messrs. Simon-Carves, Ltd., for the complete boiler plant with all auxiliaries required in connection with an extension to the Cawnpore power station. This order follows on the installation and successful operation at this station of a similar though smaller Simon-Carves boiler. The new contract includes two of the company's multiple drum type boilers each having an evaporative capacity of 120,000 to 165,000 lb. of steam per hour at 430 lb. per sq. in. pressure with a final steam temperature of 800 deg. F. The boilers will be fired by pulverised fuel as the local coal employed, though of a reasonable calorific value, gives poor results when fired in any other manner. The pulverising plant will consist of five Simon-Carves unit type pulverisers per boiler, four of which will be sufficient to carry the full load. The boiler will be complete with water-cooled combustion chamber, super heater and steam temperature control, economiser, air heater, forced and induced draught fans, valves and fittings, instruments, &c. An interesting feature is that an electrostatic flue gas cleaning plant is to be installed which will prevent any nuisance being caused by dust emission. The value of the contract is in the neighbourhood of £100,000, and all the plant included will be of British manufacture.

Lighting in a Council's Offices

The new offices of the Chigwell Urban District Council which were opened recently provide an excellent example of Holophane lighting. The Council Chamber contains six square lighting panels which are built flush with the ceiling.

The new offices of the Chigwell U.D.C.

Each panel is equipped with four Holophane "Hedralite" plates, above which are four 75-W lamps with focusing type prismatic reflectors. Our picture shows the exterior of the building, which is illuminated by a Holophane "H.F. 1000" floodlight.

Transformers for South African Railways

The recent shipment of four large transformers from the South West India Docks for Durban is of particular interest, as these equipments are for use with mercury-arc rectifiers now being manufactured by the British Thomson-Houston Co., Ltd., in connection with extensions to the electrification of the South African Railways. The order for these equipments was received by the B.T.H. Co. through its South African representatives, Messrs. Wilson & Herd, Ltd., from the Electricity Supply Commission, and is claimed to be the largest single contract ever placed for mercury-arc rectifiers for inverted operation. The order includes twenty rectifiers, which are to be installed in ten sub-stations on the Cato Ridge-Durban section and the Glencoe-Volksrust section. The incoming supply is 88,000 V, 3-phase, 50 cycles, while the outgoing is 3,000 V d.c. Each rectifier transformer has two secondary windings, each for connection to a separate mercury-arc rectifier. One rectifier is arranged to supply power and the other arranged to return power to the a.c. system when the energy regenerated by the locomotives descending gradients exceeds the load demanded by other locomotives on the section. The two rectifiers are so designed as to be interchangeable in function. Inverted operation of the rectifiers is effected by means of grid control, which is also used to maintain the sub-station voltage constant under varying load conditions. The contract also includes a large number of track high-speed circuit-breakers similar to those at present used throughout the existing 3,000-V electrified section of the South African Railways.

B.T.H. transformers being loaded at South West India Docks en route for South Africa

E.D.A.'s New Campaign

A one-day sales conference attended by sixty-one representatives of supply authorities in the Mid-East England Area of E.D.A. was held at Leeds on September 25th. Mr. T. Roles, Bradford, chairman of the Area Committee, presided. Mr. V. W. Dale, business manager of E.D.A., addressed the conference on the "Million New Consumers" campaign. He dealt with the Press campaign exhaustively, and made an appeal for synchronised co-operative action. He spoke of the new feature of E.D.A. activity introduced under the second part of the campaign scheme, and forecast training schools for canvassers. An interesting discussion followed. Mr. G. H. Lake, M.I.E.E., Nottingham, addressed the afternoon session on "Canvassing." He showed by results obtained in Nottingham the value of canvassing to the undertaking. He gave details of the training and methods of the canvassers and of the internal organisation required. Mr. C. E. D. Greenhalgh (Ilkley) moved, and Mr. O. G. Cook (Bingley) seconded, a vote of thanks to the speakers.

Colour Lighting

A new system of variable colour lighting has been designed by Architectural Lighting, Ltd., for cinemas, theatres, restaurants, shop windows, &c. High intensity flexible spine tubular lamps are employed in units containing three lamps, each being screened by red, blue or green glass. By suitably inclining the two outer lamps it is claimed that perfect mixing is obtained right from the source of light without introducing any streaks of primary colours or any black spots. Practically any desired colour can be obtained by the use of ordinary standard type of hand or automatic dimmers. A considerable saving in both installation and upkeep is said to be possible, since fewer lighting points and sub-circuits are required and less troughing.

Equipment for the Queen Mary

One of the novel features of the Cunard-White Star liner *Queen Mary* will be the kaleidoscopic lighting in the ballroom. By means of a thyratron valve many hundreds of coloured lamps will be dimmed in a pre-arranged sequence producing wonderful and constantly changing colour effects. This valve is manufactured by the British Thomson-Houston Co., Ltd., which is also supplying the lighting fittings for a number of the first-class public rooms.

Messrs. Elliott Brothers (London), Ltd., have received an order from Messrs. John Brown & Co., Ltd., for twenty-four complete sets of Siemens CO_2 (flue gas analysis) equipment,

namely, a set for each of the main boilers installed on *Queen Mary*. This equipment is being manufactured throughout at the company's Century Works.

Enamel for Cookers

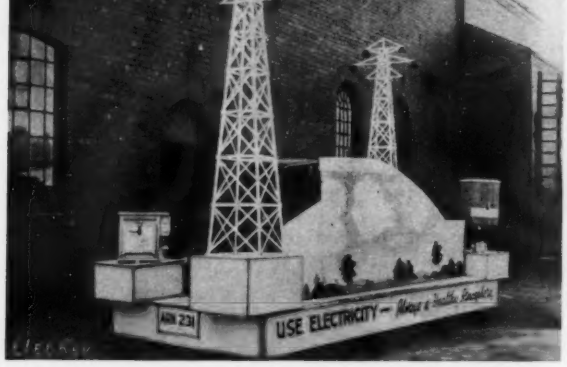
During the past few months the Blythe Colour Works, Ltd., of Cresswell, Stoke-on-Trent, have developed an acid-resisting enamel which is being used for electric and gas cookers. It is claimed that water from boiling vegetable and fruit juices do not cause the enamels to become dull or stained.

An Electrical Wiring Installation Booklet

A useful booklet has been issued by W. T. Henley's Telegraph Works Co., Ltd., on "Electric Wiring—For Complete Installations or Extensions." This deals with the company's three surface-wiring systems, viz., the "Henley," the "Bondit," and the "Nomet," and contains a number of illustrations of types of buildings in which one or other of these systems has been installed.

Electrical Activity at Bridlington

We have received from Mr. A. J. Beckett, borough electrical engineer at Bridlington, two photographs of the Electricity Department's entries in the recent carnival procession in connection with the crowning of Bridlington's "Beauty Queen." One of the entries was a replica of the E.D.A. processional car, which secured first prize in the tradesmen's



Bridlington Electricity Department's carnival tableau

section. The other is shown in the accompanying illustration.

Mr. Beckett has also sent us a photograph of the first electric vehicle to be put into commission at Bridlington, showing some of the members of the Mid-East England Area of E.D.A. inspecting it on the occasion of the last meeting in Bridlington. The vehicle is owned by the Bridlington Steam Laundry, Ltd.

S.S. "Strathmore"

With reference to our article on the electrical equipment of this vessel (ELEC. REV., Sept. 27th, p. 398) we are informed by Messrs. Osler & Faraday, Ltd., that the major portion of the decorative electric lighting fittings were designed by them in collaboration with the architects, Messrs. McInnes, Gardner and Partners, and made by them to the order of Messrs. Waring & Gillow, Ltd.

Modern Electric Discharge Lamps

A paper by Messrs. H. R. Ruff and L. J. Davies, read at the Birmingham Electric Club on September 27th, explained the mechanism and characteristics of the various types of lamps recently developed and now in fairly general use. The necessary and desirable characteristics for artificial light sources were fully dealt with. The authors demonstrated examples of the most practical lamps available, illustrating various novel features and explaining the necessity for investigating the requirements of each particular application before deciding which artificial light source would prove most satisfactory.

Cooking Demonstrations at Willesden

The hiring of 476 electric cookers in a period of four days must be a record for this country. The cookers were not hired in a block to a housing estate, but to individual consumers in the area of the Willesden Borough Council. The Electricity Department recently decided to arrange a special electric cooker campaign and to this end enlisted the assistance of the General Electric Co., Ltd. The Drill Hall in Pound Lane was requisitioned for four days and a series of cooking demonstrations were undertaken and two tableaux presented to show the striking difference between domestic conditions when electricity is and is not used. The opportunity was taken to particularly advertise the new "kitchen scheme" recently introduced by Mr. J. D. Spark, the electrical engineer and manager, whereby electric cooking may be obtained through a prepayment meter calibrated at 1d. per kWh which includes the fixed charge of the domestic tariff and the hire charge for the cooker and wiring. When the required number of kWh is consumed, one half of the value of which will repay the fixed charges and hire charges, the consumer obtains a rebate of ½d. per kWh on all additional energy consumed. The capacity of the hall was 650 but it was found necessary to provide additional accommodation in a marquee on the parade ground and it was possible to entertain a further 200 people in this, where a talk on the scheme was given, followed by a demonstration of electric cooking by the Department's demonstrator. A play which preceded the demonstration was produced by General Electric Co. and the demonstrations in the main hall were carried out by Mrs. Flack and Miss Powell of that company. During the four days of the exhibition 7,000 people witnessed the demonstrations and, in addition to this, numbers had to be turned away. At each session a member of the Electricity Committee addressed the audience and outlined the schemes which were available for consumers desiring to hire electric cookers.

Wiring Regulations Simplified

The Association of Supervising Electrical Engineers, Aldwych House, Aldwych, W.C.2, informs us that further supplies of cloth-bound copies of the "Employees' Guide" to the I.E.E. Wiring Regulations (10th edition) are now available at 1s. 6d. (1s. 9d. post free). Paper-covered copies at 1s. (1s. 2d. post free) are also available.

The Kettering Radio Exhibition

The third radio exhibition organised by Kettering Radio and Physical Society and held at the Central Hall, Kettering, on September 26th, 27th and 28th, proved an even greater success than in previous years, the attendance on the opening day being more than doubled. Declaring the exhibition open, Mr C. W. Clarke, J.P., referred to the fact that the proportion of Kettering's population holding wireless receiving licences was greater than in any other town in the country. Practically every radio and electrical dealer in Kettering co-operated with the Radio Society by exhibiting. Demonstrations of high-definition television arranged by Mr. J. H. Reyner, B.Sc., A.M.I.E.E., and his assistant, Mr. Vaughan Jones, were given. Short-wave transmitting and receiving apparatus was shown on the Radio Society's own stand, including 5-metre gear, pocket radio sets used by police, midget receivers, &c., while cathode-ray oscillographs and light-sensitive apparatus were demonstrated. During the three days of the show electric vehicles equipped with amplifiers and loud speakers toured the town for advertising purposes.

Trade Announcements

Messrs. H. S. Field and Co., Ltd., 44, Theobalds Road, London, W.C.1, inform us that they are now the sole selling licensees for the "Nu-Este" window-cleaning machine.

Messrs. Clifford & Snell (Eng.), Ltd., have opened new works in Carshalton Road West, Sutton, Surrey, where they are producing "Loudaphones," "Ordasigns," and other apparatus.

The Telsen Electric Co., Ltd., Manchester, has now added a fully equipped radio instrument department to the new works in Manchester. Mr. J. Grant, late of Messrs. Ferranti, Ltd., and the Granton Instrument Co., Ltd., has been appointed technical manager of the branch.

Messrs. Thomas & Owen, electrical contractors, of Merthyr Tydfil, have removed their business to larger premises at 85, High Street.

Dulcetto-Polyphon, Ltd., has just opened a large new showroom for the display of all kinds of domestic electrical equipment and fittings at its premises at 2-3, Newman Street, London, W.1.

For Sale

Southend Electricity Department has for sale d.c. meters and motors, d.c. to a.c. rotary convertors and scrap metals.

The Stretford and District Electricity Board offers for sale three steam-engine generating sets, &c.

The Northampton Electric Light & Power Co., Ltd., has for sale two Bellis & Morcom steam engines.

(See our classified advertisements.)

The Business Efficiency Exhibition

The Business Efficiency Exhibition opened on Wednesday at the White City, London, and will continue until October 12th.

A Keighley Exhibition

A four-day exhibition of electrical appliances was held at Keighley Municipal Hall from September 24th to 27th, under the auspices of the Corporation Electricity Department. The Mayor (Ald. T. Broster) opened the show, the chair being occupied by Councillor J. Spencer Binns, chairman of the Electricity Committee. In the course of the speeches it was mentioned that Mr. Harry Webber, the borough electrical engineer, this year completes twenty-five years at Keighley. Capt. A. W. Brown, ex-Lord Mayor of Bradford and North Midland area officer of the E.D.A., moved thanks to the Mayor, and Mrs. Poole, chairman of Bradford District section of the Electrical Association for Women, seconded.

Lamp Publicity

We have received from the Crystal Twinlight Co. (an Ismay Company) some specimens of its publicity material for "Doto" double filament crystal lamps. This includes a

counter showcard with a cut-out of the "Doto" crystal lamp and illustrating the "Doto filament twins," and three leaflets describing the lamp and its advantages. Particulars of this lamp are given in our "New Apparatus and Devices" section.

New Cooper-Stewart Factory

To cope with expanding business the Cooper-Stewart Engineering Co., Ltd., is transferring its production to larger premises at Albert Road, Hendon. The new factory has a floor area of 25,000 cu. ft., and when working to full capacity will provide employment for at least 150 workpeople.

An Electro-plating Handbook

"The Electro-Plating and Metal-Finishing Industry," by A. S. Round (1s. post free) describes the "Epalex" system of Messrs. B. J. Round & Sons. Most of the space in the book, however, is devoted to clear and simple explanations of the various processes in use to-day, giving properties and general information concerning deposits, procedure previous to plating, and tabulated facts regarding electro-deposition.

Prices of Materials

Messrs. Frederick Smith & Co. report, October 2nd:—Electrolytic copper bars, £39 15s., 5s. increase; ditto, ditto, wire rods, £41 5s., 5s. increase. No change in the price of electrolytic copper h.c. wire and silicium bronze wire.

Messrs. Henry Gardner & Co. report, October 2nd:—No change in the price of copper bars (best selected), sheet and rod. English pig lead, £19 5s., £1 increase.

Messrs. Edward Till & Co. report, October 2nd:—India rubber, Para fine, 5d., ¼d. increase.

New Catalogues and Lists

Inventum Electrical Appliances, Ltd., Northend Road, Wembley Park.—A list of electric fires.

Dubilier Condenser Co. (1925), Ltd., Ducon Works, Victoria Road, W.3.—A new catalogue of condensers and resistances for radio purposes.

Holden & Brooke, Ltd., Sirius Works, Manchester, 12.—A leaflet on the new "Slik" steam trap.

Rowlands Electrical Accessories, Ltd., R.E.A.L. Works, Hockley Hill, Birmingham, 18, have issued a new publication "Realumination," dealing with the company's developments in lighting fittings.

Sun Electrical Co., Ltd., 118, Charing Cross Road, W.C.2.—The new season's radio catalogue. In this, the 22nd, issue an effort has been made to show attractively the instruments which are likely to be the leaders of the 1936 market. The matter facing each illustration is a really serviceable specification of the apparatus.

Berkeley & Young, Ltd., Tyseley, Birmingham, 11, have issued a new season's list of fires and cooking equipment.

Geo. Bray & Co., Ltd., Leeds, 2.—A leaflet on a motor car engine heater.

W. Andrew Bryce & Co., Woodfield Works, Bury, have issued a catalogue of radio and allied components, giving weights and dimensions.

Fry's (London), Ltd., 24, King Street, E.1.—Leaflets on a pocket saw and circular drill stand.

British National Electrics, Ltd., Newarthill, Motherwell.—A leaflet on inset fires.

Siemens Electric Lamps & Supplies, Ltd., 38/39, Upper Thames Street, E.C.4.—Particulars of the new season's "Full-o'-Power" battery.

Thermal Syndicate, Ltd., Wallsend-on-Tyne.—Details of the "Vi-tan" ultra-violet home unit.

Kandem Electrical, Ltd., 711, Fulham Road, S.W.6.—Leaflets on Hartmann & Braun measuring instruments, including galvanometers, ammeters and voltmeters.

Brook Motors, Ltd., Huddersfield, have issued a complete catalogue of hand-operated starters.

J. B. Rudkin & Co., Ltd., 59, New Oxford Street, W.C.1.—A catalogue of outdoor switchgear and fuses for rural distribution.

Switchgear & Equipment, Ltd., Delavox Works, Banbury.—A pamphlet on an oil-immersed self-reclosing circuit-breaker.

Bankruptcy Proceedings

Electrical Supply Stores (a firm), 36/37, Merchant Street, Bristol, electrical dealers.—Miss Bertha Adams, who traded as above, attended at the Guildhall, Bristol, on September 27th, for her public examination. She stated that her liabilities amounted to £557, and estimated her assets at £49. She commenced the business in 1932, with a capital of £66. The business had not been successful. Creditors had pressed and eventually the stock was sold under executions. Debtor estimated the loss on those sales at between £250 and £300. The examination was concluded.

H. C. Bridgman, 37, Canynge Road, Clifton, Bristol, lately 7, Abbey Road, Westbury-on-Trym, electrical engineer.—The public examination was held at Bristol on September 27th. The statement of affairs showed liabilities of £931, assets of £33, and a deficiency of £898. Debtor attributed his failure to insufficient net profits to cover living expenses, and repayments to the bank and mortgagees. He admitted that he had lost money through Stock Exchange operations. He was ordered to file a copy of his banking account, and the examination was adjourned.

C. B. B. Maturin (I.M.S. Radio Co.), Lattimore Road, St. Albans, Herts, company director.—At this debtor's recent public examination the Assistant Official Receiver stated that the observations to creditors had not yet been issued owing to the statement of affairs as lodged not being quite correct. He asked that the debtor should be instructed to lodge an account showing how a loss of £6,272 shown in the deficiency account under the heading "net loss in trading" was arrived at. The Registrar made an order accordingly.

G. Bond, electrical and wireless dealer, Leeds Road, Nelson, Lancs.—This debtor's application for discharge was heard at Burnley on September 26th. He was adjudicated bankrupt in July, 1933. The ranking liabilities were estimated at £724, and the assets had realised £209. A first and final dividend of 3s. 7½d. in the £ had been paid on proofs for £699. The discharge was granted subject to eighteen months' suspension.

F. C. S. Blake, 6, Berkeley Road, Tunbridge Wells, wireless dealer.—The public examination was held on September 25th at Tunbridge Wells. The statement of affairs showed a deficiency of £843. The debtor attributed his failure to lack of capital and heavy advertising and overhead expenses. The examination was adjourned.

R. L. D. Mathews, wireless and electrical engineer, 24, Kingsway Road, Burnham-on-Sea.—Receiving order made September 27th on debtor's own petition.

S. D. C. Orchard (Empire Radio), electrical engineer, 43, Malmesbury Road, Shirley, Southampton.—Receiving order made September 25th on a creditor's petition.

E. C. Sparkes, electrical manufacturers' agent, 118, Wardour Street, W.C.—Application for discharge to be heard on October 15th at Bankruptcy Buildings, Carey Street, W.C.

C. Uren (Eclipse Wireless Co.), wireless dealer, 120, Stapleton Road, Bristol.—Trustee, Mr. H. Wheeler, 26, Baldwin Street, Bristol, Official Receiver, released September 20th.

B. A. E. Hinkins, radio dealer, 322, Torquay Road, Paignton.—First meeting October 4th and public examination October 24th, both at the County Court Offices, Old Town Hall, Torquay.

W. J. Richardson, wireless dealer, 14, Highthorne Avenue, Bradford Moor, Bradford.—Trustee, Mr. F. H. Langmaid, 71, Manningham Lane, Bradford, Official Receiver, released September 20th.

S. F. Philpott (S.F.P. Electrical Co.), electrical engineer, North Bar Works, Banbury.—Last day for receiving proofs for dividend October 12th. Trustee, Mr. E. H. Goddard, Prudential Chambers, Banbury.

E. H. Newman and **M. Baynes,** lately trading as Langham Radio at 96, Regent Street, W. (separate estate of M. Baynes).—First and final dividend of 19s. in the £, payable at Bankruptcy Buildings, Carey Street, W.C.

C. Worden, electrical engineer and radio dealer, 5, St. Alban's Road, Darwen.—Last day for receiving proofs for dividend October 12th. Trustee, Mr. A. H. Ward, District Bank Chambers, Blackburn, Official Receiver.

E. H. Newman and **M. Baynes,** lately trading as Langham Radio, at 96, Regent Street, W. (separate estate of E. H. Newman).—First and final dividend of 3s. 2d. in the £, payable at Bankruptcy Buildings, Carey Street, W.C.

Private Arrangement

S. E. Abbott, trading as Abbott Electric, 21, Warwick Road, Worthing, electrical engineer.—A meeting of creditors was held recently. The statement of affairs showed liabilities of £625, of which £479 was due to trade creditors, and net assets of £140, leaving a deficiency of £485. The debtor commenced trading in April, 1933, with a capital of £260. In the first year's trading debtor incurred a loss of about £300, but afterwards and up to April last he had made profits. It was resolved that the debtor should execute a deed of assignment in favour of Mr. W. A. J. Osborne, of Messrs. Corfield & Cripwell, Balfour House, Finsbury Pavement, E.C., as trustee.

Company Liquidations

J.B. Electrical Co., Ltd., Victoria Street, London, S.W.1.—A meeting of creditors herein was held recently when Mr. J. S. W. Bartley, a director of the company, presided. It was stated that the shareholders had nominated Mr. Warne, 125, High Holborn, London, W.C., as liquidator. A statement of affairs as at September 20th last was submitted which showed liabilities of £7,594, of which £2,447 was due to trade creditors; Messrs. J. S. W. Bartley and N. Davidson were loan creditors for £4,781, there were claims in respect of wages and commissions, £19, whilst the bank were creditors for £347. The net assets were £1,565, leaving a deficiency as regarded creditors of £6,029. The share capital of the company was £100, so that the deficiency as regarded contributories was £6,129. The company was incorporated in October, 1931, as wholesale factors, and a considerable amount of business was done with the St. James Electrical Co., Ltd. The directors attributed the present position partly to too high commissions being paid to salesmen, and to selling goods at unremunerative prices with the object of establishing a connection. The creditors passed a resolution confirming the appointment of Mr. Warne as liquidator.

St. James Electrical Co., Ltd., Victoria Street, London, S.W.1.—A meeting of creditors was held recently, when Mr. Davidson, a director of the company, presided. A statement of affairs as at September 20th last was submitted showing liabilities of £6,771, of which £1,683 was due to the trade; Messrs. J. S. W. Bartley and A. D. Davidson were creditors for £3,518, and the bank's claim amounted to £1,570. The net assets were £916, leaving a deficiency of £5,855 as regarded unsecured creditors. The share capital of the company was £100, so that the total deficiency as regarded contributories was £5,955. The company was formed in June, 1932, and carried on business as electrical contractors. The trading resulted in losses, and to assist the company the directors had made advances. The shareholders had passed a resolution for the nomination of Mr. Warne, 125, High Holborn, E.C., as liquidator of the company, and as the creditors passed no resolution, the liquidation will remain in his hands.

England-Richards Fluid-Free Cell Co., Ltd., Waterloo Street, King's Lynn.—At the statutory meeting of creditors of this company a statement of affairs was submitted which showed ranking liabilities of £2,063. In addition the bank were fully secured creditors for £1,512. The net assets were £1,061, leaving a deficiency, so far as the creditors were concerned, of £1,001. It was reported that the company was registered in August, 1928, the issued capital being £2,429. It traded successfully for a number of years, but finally it was decided that voluntary liquidation should take place, and Mr. J. C. Thornley, of Messrs. Stephenson, Smart & Co., had been nominated as liquidator. The creditors decided to confirm Mr. Thornley's appointment and also appointed a committee.

Perry & Co. (Overseas), Ltd.—Meetings October 8th at 11, Ironmonger Lane, E.C., to receive an account of the winding-up by the liquidator, Mr. W. H. Peat.

Electricity Supply

Lighting, Domestic, Power

Ardersier (Inverness-shire).—NEW LIGHTING SYSTEM.—Hitherto the street lighting has been by paraffin lamps, at an annual cost of between £35 and £45. Recently an electric system was inaugurated, the cost with twenty-eight lamps over a longer lighting season being estimated at £52 a year. The installation was carried out by Edmundsons' Electricity Corporation, Ltd., the energy being obtained from the Grampian Electricity Supply Co.

Barking.—SWIMMING POOL LIGHTING.—The Baths Committee has asked for an estimate of the cost of providing underwater lighting at the open-air swimming pool.

Bexhill.—EXTENSIONS TO ESTATES.—The Electricity Committee is to extend mains to the Glenleigh Park estate at a cost of £344 and to the Whitehorse Farm estate (£238).

Birmingham.—ELECTRIC-DISCHARGE LIGHTING.—The accompanying photograph illustrates the lighting of Birchfield Road, Birmingham, where thirty 400-W "Osira" lamps have recently been installed in specially designed G.E.C. lanterns manufactured to the requirements of the Public Lighting Department. These lanterns employ a similar optical system to that embodied in the "Watford" and "Lewisham" designs. They are mounted at a height of 25 ft. above the

Birchfield Road, Birmingham, illuminated by 400-W "Osira" lamps

roadway, and the spacing between each on the stretch illustrated varies from 125 ft. to 240 ft. The installation was carried out under the supervision of the lighting engineer, Mr. A. V. Blake.

Bournemouth.—ELECTRIC STREET LIGHTING.—The Corporation decided yesterday to light, for the first time, ten miles of its principal thoroughfares by electricity, to be obtained from the Bournemouth & Poole Electricity Supply Co., Ltd., an associated company of the County of London Electric Supply Co., Ltd.

Chichester.—TARIFF REDUCTION.—The City Council has reduced the charge for all electricity consumed over 200,000 kWh per annum to 0.7d. per kWh.

Croydon.—MAINS EXTENSIONS.—The County of London Electric Supply Co. is to extend its mains in the Addington district at a cost of £1,272, while the Electricity Department is to carry out similar work at a cost of £2,383 to supply 150 houses on the L.C.C. Norbury estate under the Department's rental wiring scheme.

LOANS.—Sanction to borrow £6,600 for mains and plant, £75,000 for mains, and £40,000 for wiring installations has been obtained by the Electricity Committee.

Denmark.—LARGE INCREASE IN CONSUMPTION.—On the basis of reports from 96 per cent. of the country's electricity works, the Department of Statistics at Copenhagen has published figures for the first half of this year. The total consumption is estimated at 302 million kWh, which is 32 million kWh more than in the corresponding period of last year, an increase of 12 per cent. Home production decreased by 12 million kWh to 255 million kWh, while imports of power (from Sweden) rose from 3 million kWh in the first part of 1934 to 47 million kWh this year.

Dunblane (Perthshire).—CATHEDRAL LIGHTING.—The Cathedral has been provided with electric lighting by an anonymous donor at a cost of £1,250. Sixteen wrought-iron pendants each carry eight lamps, which can be dimmed to any desired extent. The installation was carried out under the supervision of Mr. J. W. Paterson, of the Office of Works, Edinburgh.

East Ham.—MODIFIED DOMESTIC TARIFF.—The Electricity Committee has recommended that the domestic tariff running charge shall be ¾d. per kWh up to 200 kWh per quarter and ½d. per kWh for all consumption in excess of that amount. At present the higher charge applies to 500 kWh.

MAINS EXTENSIONS.—Mains are to be extended at a cost of £4,500.

Germany.—REORGANISING ELECTRICITY PRODUCTION.—In a recent speech at Saarbrücken, Dr. Schacht stated that a law would be passed in the near future empowering the Government to reorganise the production of electric power so as to provide cheap electricity, equalising the rates in various districts as far as possible, and to safeguard the supply. On the latter point Dr. Schacht said that the industry must be rendered fit for the defence requirements of the country. In order that the supply network should not be disturbed by the failure of individual sources of production co-operation and inter-relation were essential, and it was necessary that the industry should be centrally controlled. It was not the Government's intention, however, to nationalise the production of power.

Glasgow.—CHANGE-OVER AND RADIO SETS.—At a meeting of the Corporation recently it was stated that through the change from d.c. to a.c. hundreds of householders in the East End had had their radio apparatus rendered useless, and because of their small incomes most of the householders made the weekly payments for their sets over a long period. In view of these circumstances the Electricity Committee was asked to consider the claims of the householders affected to the extent of replacing or reconstructing the sets, in the same way as the claims of business firms were being attended to. Mr. Alex. Munro, convener, replied that the number of householders in the Dalmarnock ward whose radio apparatus was affected was small, and that the difficulties arising from the request were manifold.

MAINS EXTENSIONS.—The Electricity Committee has agreed to the laying of distributing mains at a cost of £1,265.

FLOODLIGHTING PUBLIC BUILDINGS.—In a report on the question of floodlighting public buildings, the manager of the Electricity Department states that the number of suitable buildings over which the Corporation has sole jurisdiction is not more than three. He adds that, without exception, the owners of other buildings are not prepared to bear any part of the cost of floodlighting. As a preliminary he has prepared a scheme for lighting the west front of the City Chambers, and the north, west and south faces of the tower. The first cost of the installation, with the addition of one year's operation on the basis of 500 hours' illumination, is estimated at £2,000.

Hexham.—A SUCCESSFUL EXPERIMENT.—The recent floodlighting of Hexham House bowling green for competitions resulted not only in a large number of visitors being attracted to the town, but also in a handsome balance in the receipts from the competitions. The Hexham and District Electric Supply Co., Ltd., provided the floodlighting equipment without charge, and also carried out illuminations in other parts of the town.

Hull.—SCULCOATES EXTENSION.—The official ceremony of inaugurating the new 25,000-kW generating set at the Sculcoates power station has been fixed for October 24th.

STREET-LIGHTING PROGRESS.—At a recent meeting of the Electricity Committee the electrical engineer reported that the revised terms for street lighting would save the Works Committee over £1,000 a year. He added that whereas in 1929 there were only 200 electric street lamps in the area, the number was now about 5,000.

SUPPLY TO BISHOP BURTON.—It has been decided to use underground mains instead of overhead lines for an extension to Bishop Burton, the extra cost being £475.

Ilford.—CHEAPER POWER.—The Town Council has reduced the charges for power, the sliding scale ranging from 1.5d. per kWh up to 1,500 kWh per quarter, to 0.8d. for over 250,000 kWh.

Kingston-upon-Thames.—LOWER CHARGES.—As from the meter readings for the third quarter (approximately October 1st) lower charges for electricity are being brought into force. For lighting the new rates are: 12,000 kWh per annum, 3d. per kWh (3½d. previously); from 12,000 kWh to 24,000 kWh, 3d. (same); from 24,000 kWh to 48,000 kWh, 2d. (2½d.); and above 48,000 kWh, 2d. (same). For the lighting of all buildings used exclusively for religious purposes the charge is 2d. (3d.) per kWh, while for cinemas the new rate is £8 10s. per annum per kW of maximum demand, plus a "unit" charge of ½d. In the case of the two-part tariff the charge per kWh is now ½d. throughout the year instead of ¾d. in the summer and ½d. in the winter. Mr. T. A. Kingham is the borough electrical engineer.

EXTENSIVE ELECTRIC-DISCHARGE LIGHTING.—"Mazda Mercra" electric-discharge lighting has been adopted for various main thoroughfares, including Portsmouth Road, Cambridge Road, Richmond Road, St. James' Road and Coombe Lane, and altogether 137 units are to be erected. The whole installation has been planned by B.T.H. lighting engineers in conjunction with the borough electrical engineer. So far only the Portsmouth Road section has been completed, and work is proceeding on the other sections of the scheme. The Portsmouth Road installation comprises twenty-one units, for which new standards have been erected. The equipment for each unit consists of a 400-W lamp housed in a "Diron" lantern, with control gear and time switch mounted in the base of each standard. The units are spaced at distances

varying from 150 to 165 ft., and are mounted at a height of 25 ft. For the remaining 116 units the same type of lantern and lamp have been specified. Seventy-eight of these units will be fixed on existing trolley-bus standards, and for the remaining thirty-eight new standards will be erected. Control equipment for the seventy-eight trolley-bus standards will be housed in a control box attached to each standard. For the thirty-eight new standards arrangements will be similar to those for the Portsmouth Road installation.

Portsmouth Road, Kingston, illuminated by B.T.H. electric discharge lamps

Littleborough.—Concession to Consumers.—Protests have been made to the Electricity Committee with reference to the minimum charge of £1 per annum for electricity consumed. The Committee has now recommended that the amount paid in meter rentals shall be included in calculating the consumption of electricity for the purpose of the minimum charge of £1 per annum.

London.—Lambeth.—The South London Electric Supply Corporation, Ltd., which is associated with the County of London Electric Supply Co., Ltd., has been informed by the Council that 20 miles of main and secondary streets in North Lambeth are, for the first time, to be lighted by electricity. Electric-discharge lamps are to be used, 390 of which will be erected in place of the existing 727 lighting units. This is the first time that a decision has been made in the London area for the entire illumination of the public streets by the electric-discharge system.

Mansfield.—Cheaper Electricity.—Consumers will benefit to the extent of approximately £6,800 as a result of reductions in tariffs which have been authorised by the Town Council. Of this sum £4,200 is in respect of lighting. Maximum-demand lighting is reduced from 7d. and 2d. to 7d. and 1d. per kWh; and the flat rate from 4½d. to 4d. per kWh (with slot meters from 5d. to 4½d. per kWh). The special allowance to large power users is increased from 12½ per cent. to 15 per cent., and the new low-rate power charge is 1d. per kWh (1½d.). The cinema tariff is revised as follows: First 1,000 kWh per month reduced from 3½d. to 3d. per kWh; second 1,000 from 2½d. to 2d.; beyond, 1d. per kWh.

Northern Ireland.—Belfast.—Last week the Finance Committee approved an expenditure of £180,000 by the Electricity Department over a period of two years. The money will be spent on new distribution works.

Norway.—A Lighting Dispute.—Representatives of fifty trades in Oslo resolved at a meeting recently that from September 23rd to 28th all shop lights and light signs should be extinguished at the close of office hours to show the authorities to what extent shop lighting adds to the lighting of the streets. The step was taken as a protest against shop-keepers being charged 26 ore per kWh while private consumers pay only 5 ore.

Proposed Power Station for Oslo.—Our Copenhagen correspondent reports that the Oslo Town Council is dissatisfied with the price charged for power by the State Waterfalls Department, and at a recent meeting plans for a municipal power plant were introduced. It was urged that with lower charges for electricity it should be possible to double the city's consumption within ten years. The plans provide for a waterfall power plant at Holsvassdraget, comprising six generator units each of 30,000 h.p. normally, but allowing for a peak output of up to 36,000 h.p. Including an additional 30,000 to 40,000 h.p. from the adjacent Gol falls, the projected plant should be able to deliver a maximum of about 250,000 h.p. to Oslo.

Olney.—Gas Lighting Superseded.—Since 1854 street lighting has been by gas lamps, but an electric system has now been introduced. In the main thoroughfare there are seven electric-discharge lamps, those in other streets being of the 300-W filament type.

Petersfield.—Overhead Lines.—The Rural District Council has examined the Mid-Southern Utility Co.'s proposals for overhead low-voltage lines at Coldhayes and Steep Marsh, and has decided to oppose them. The company also gave notice that it intended to extend the h.v. main in Hollycombe Road, Liphook, from Admers to the county boundary, and then to Hollycombe House. This the Council approved.

Salford.—Sub-station.—A site has been purchased in Heaton Park, Prestwich, for the erection of a sub-station.

Loan.—The Electricity Committee is seeking sanction to borrow £14,000 for mains and £6,000 for services.

Sheffield.—Cheaper Electricity for Churches.—The Electricity Committee proposes to reduce to 2d. per kWh the charge for lighting in churches, church halls and halls for public meetings and (or) entertainments of an occasional character in respect of which the lighting load is generally required at off-peak periods.

South Africa.—Hydro-electric Scheme.—An *Exchange Telegraph* message from Bulawayo states that steps are to be taken immediately to harness the Victoria Falls by the construction of a hydro-electric power station in the third gorge at Silent Pool. The plant, consisting of two 1,000 kW machines, will be hidden in the gorge in order not to spoil the beauty of the Falls. In the course of a conference at Lusaka during the week-end between Sir Hubert Young, Governor of Northern Rhodesia, the Mayor of Livingstone and a representative of the Victoria Falls and Transvaal Power Co., it was agreed to install the plant immediately and to supply power to Livingstone for a period of 25 years.

Stretford.—Lower Charges.—During the last financial year a net profit of £27,298 was made by the Stretford and District Electricity Board, which also serves Urmston, Flixton and Irlam. At the end of the year the number of consumers was 22,923, more than twice as many as at the end of 1930. Reductions in charges are to come into force in the December quarter, including a decrease from 1d. to ¾d. per kWh for domestic heating and cooking above 200 kWh per quarter, and of ¼d. to 4d. per kWh in the case of the lighting rate, with 2½ per cent. discount on accounts paid within one month.

Sweden.—Consumers' Strike.—When the Tallasen electricity works were rebuilt after a fire the supply was converted from d.c. to a.c. A dispute arose between the works management and consumers as to the costs of alterations to appliances, and the consumers decided to disconnect their households from the mains. Efforts are now being made by them to subscribe capital for the erection of a plant of their own, states our Copenhagen correspondent.

Tenterden.—Rural Extensions.—The Weald Electricity Supply Co., Ltd., has informed the Rural District Council of its intention to canvass Kenardington. The Council has consented to the erection of overhead lines at Rolvenden and Wittersham.

Uxbridge.—Electricity for Council Houses.—A number of tenants in Frayswaye have petitioned the Council for electric lighting to be installed in their houses. The Council is of the opinion that the question of affording such supplies should be dealt with as a whole, and the application has been deferred pending a report.

Wrexham.—Tariff Modifications.—The Town Council has amended the electricity charges. The new lighting flat rate is 4d. per kWh up to 1,000 kWh per quarter (subject to a minimum net charge of 6s. 8d. per quarter); 3½d. per kWh from 1,000 to 2,000 kWh, and 2½d. per kWh beyond, less 5 per cent. discount for prompt payment of accounts. For shop lighting where over 250 kWh is used during the summer quarters and over 500 kWh during the winter quarters there is to be a charge of 1¾d. per kWh, less a discount of 5 per cent., with a fixed rental of 2s. 6d. per summer quarter and 6s. per winter quarter for each 100 W installed.

Traction

London.—Underground Railway Improvements.—The latest plans for the modernisation of the Underground Railway stations provide for a new station on the Central London line at the junction of Newgate Street, Cheapside and St. Martins-le-Grand to replace the existing Post Office station; the reconstruction of Moorgate and King's Cross stations; and improvements at Sloane Square, including the installation of escalators. The King's Cross Metropolitan station is to be rebuilt in a better position in relation to the "tube" and main-line stations, while a new sub-level booking hall is to be built for the "tube" lines under the road approach to the L.N.E.R. main-line station.

Lytham St. Annes.—Purchase of Tramway Undertaking.—Although the tramway undertaking has a debt of £116,200 and makes a yearly loss of £5,000, the Blackpool Corporation has made an offer to purchase it. If the negotiations succeed it will be possible to run through cars along the eighteen miles of the Fylde from Lytham to Fleetwood.

Rochester.—Request for Railway Electrification.—The City Council is to join the Gillingham Council in urging the Southern Railway to extend its electrified system from London to Gillingham.

Southern Railway.—New Electrified Lines.—On September 30th the Southern Railway inaugurated new electrified lines connecting the Dartford to Charing Cross and Nunhead and Catford to St. Paul's lines at Lewisham Junction. The line

between Woodside and Sanderstead *via* Addiscombe and Selsdon has also been converted to electric traction. The new electrification works have cost £233,000.

South Shields.—TROLLEY-BUS PLANS.—Further details are available of the proposed introduction of trolley-bus services, for which Royal Assent has been secured. It is proposed to undertake the work in two stages. The first route is from the Market Place to Freemantle Street *via* Laygate, Westoe Parade, Mortimer Road, King George Road and Prince Edward Road East. This section covers 3.5 miles and the new overhead equipment for 1.97 miles will cost £5,910. To this it is necessary to add £3,240 for supplementary wiring on the existing tram route: £8,000 for four double-deck vehicles; £1,000 for depôt equipment; and £4,000 for sub-station equipment and cables, making a total of £22,150. The second route is to be from Freemantle Street to the Market *via* Prince Edward Road East, Coast Road, Ocean Road and King Street. This will involve 3.16 miles of overhead equipment, costing £9,480; £2,000 for cables and £8,000 for four trolley-vehicles, making a total of £19,480. It is hoped to have the first stage ready by next autumn and the other section by the spring of 1937.

A new 10-kW Marconi transmitter which is being installed at Grahamstown, South Africa

Stalybridge and District.—TROLLEY-BUSES.—The Stalybridge, Hyde, Mossley, and Dukinfield Joint Tramways and Electricity Board is seeking to obtain powers to operate trolley vehicles. The object is that in the event of neighbouring authorities adopting this style of transport the Board would be in a position to arrange for inter-running.

Communications

Germany.—SAAR RADIO STATION.—It is reported that Germany is to erect a broadcasting station in the Saar. It will work on a wavelength of 240 metres, which is the position allotted to Luxemburg under the Lucerne plan.

Great Britain.—NEW RADIO TRANSMITTERS.—A paragraph in our September 27th issue announced the placing of an order by the British Broadcasting Corporation with Standard Telephones & Cables, Ltd., for two high-power transmitters, one for the Empire station and the other for North-Eastern England. We are now informed that recently the B.B.C. placed an order for two high-power short-wave transmitters for the Empire station, one of which (as mentioned) will be manufactured by the Standard Company, while the order for the other transmitter has been given to the Marconi Company. Of the three high-power broadcast transmitters which the B.B.C. is adding to its existing stations the Marconi Company has been entrusted with the construction of those for Northern Ireland and Northern Scotland.

Greece.—BROADCASTING.—The small broadcasting station of Salonica has been restarted with a power of 1.25 kW on a wavelength of 233.5 metres.

Sweden.—ANTI-INTERFERENCE CAMPAIGN.—Since last April, when a sum of 75,000 kroner (£3,750) was granted by the Post Office for anti-interference research work, the Committee on Noise Suppression has been active, and a public report was issued a short while ago. The electricity works at Stockholm, Göteborg, Djursholm, Eskilstuna, and about twenty other large cities have been persuaded by the Committee to revise their conditions of contracts for the supply of electricity with a view to eliminating disturbance of broadcast reception. New clauses have been inserted in the contracts by which consumers are obliged to fix noise-suppression components to all electrical appliances which are apt to cause interference. Negotiations with individual electricity works are being kept up, and the Committee believes that very soon all power companies in the country will co-operate.

Trolley Buses for London

IN our issue of September 6th we mentioned the sixty-eight trolley buses with Met.-Vick electrical equipment which Leyland Motors, Ltd., is supplying to the London Passenger Transport Board. The Board has also ordered 252 similar vehicles from the Associated Equipment Co., Ltd.

These vehicles are of the six-wheel type with wheelbases of 18 ft. 7 in. and follow closely the design of the experimental unit put into service by London Transport some twelve months ago. A feature is that, despite the fitting of additional electrical equipment, the weight of the chassis has been reduced so effectively that it has been possible to build on them 70-seater bodies.

A new development is the use of batteries for moving the vehicles in conditions hitherto unprovided for, *viz.*, in the event of the overhead supply failing, when the bus can run under its own power to a less congested thoroughfare; for reversing the bus should the normal turning circle overhead equipment be unavailable; and for moving in the depôt without the necessity of changing the trolley from one overhead set to another.

The design of the chassis has made it possible to place the driving motor behind the legal 10 in. ground clearance, and as the top of the motor is level with the top of the frame a straight drive to the rear axles has been obtained. The rear axle ratio is 10.33 to 1; and the axle centres are 4 ft. apart.

Compressed air cylinders operate brakes on the front and rear wheels. The 5 cu. ft. compressor driven by a 500-V motor, mechanically and electrically insulated from the chassis, maintains a pressure of 85 lb. per sq. in. in a steel air reservoir of 750 cu. in. capacity. An interesting innovation is the leading of the exhaust from the air brake over the resistances in front of the frame. The heat dissipation rate is thus considerably improved; so much so that in tests carried out in conditions approximating to fog operation the temperature of the resistance element was found to have been lowered by 43° C.

The electrical equipment is of the English Electric electromagnetic remote-control type. The motor develops 80 h.p. at 550 V, and the regenerative rheostatic control equipment provides the maximum flexibility of high acceleration and a wide range of running speeds, as well as smooth electrical braking down to approximately 4 m.p.h. The motor is supported within the chassis side frame on a resilient mounting. The foot operated master controller, which is of the drum type, is located under the driver's seat, the groups of contactors and shunt field resistance on the chassis side frame, and the starting resistance, as previously mentioned, within the front end of the chassis. All these units are supported on "dry spot" insulators.

Serious overloads are dealt with by means of standard circuit breakers mounted in the cab. A new feature is that normal overloads are dealt with by line contactors, calibrated to trip at a lower value than the circuit-breakers. These line breakers are fitted with automatic resets which become operative as soon as the master controller is returned to the "off" position.

The regenerative rheostatic braking system incorporated provides an efficient brake from full speed to almost standstill, the transition from regenerative to rheostatic being effected without opening the circuit or loss of braking effort. It is arranged so that irrespective of speed or position of the controller the retardation does not exceed 4 ft. per sec. per sec., thereby protecting both the transmission and the passengers from undue shocks. The rheostatic feature comes into operation automatically if a trolley comes off the line or on a line voltage failure, providing an automatic brake and at the same time preventing overvoltage on the motor and equipment.

A motor-generator set mounted on the chassis supplies the 24-V lighting and charges the nickel-iron batteries. The cells are grouped into two batteries, each of 24 V, and are connected in parallel for lighting purposes or in series to give 48 V if it is required to manœuvre the vehicle if line voltage is not available. Other features of the electrical equipment are the fitting of "double band" radio choke coils, a lightning arrestor, lightweight type trolley bases and slider heads.

Plan view of the A.E.C. six-wheel trolley-bus chassis of the type being supplied to London Transport

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Australia.—MELBOURNE.—Posts and Telegraphs Department. October 15th. Testing instruments (voltmeters, ammeters, milliameters, &c.). (T.Y. 10092.)* Voice frequency telephone repeaters and associated ringing equipment. (T.Y. 10089.)* 1,520 yd. lead and antimony covered submarine cable. (T.Y. 10114.)*
October 22nd. Terminal and/or intermediate v.f. (1,000 cycles) ringers. (T.Y. 10093.)* Lead-sheathed switchboard cable. (T.Y. 10134.)*

Birmingham.—October 12th. Electric Supply Department. Meters. (See this issue.)
October 16th. Electric Supply Department. Cookers for twelve months. (September 27th.)

Bradford.—October 7th. Electrical work at extension of Menston Isolation Hospital. Messrs. W. J. Morley & Son (architects).

Bromley (KENT).—October 7th. Electricity Department. Street-lighting standards. (September 27th.)

Burton-on-Trent.—October 18th. Electricity Department. Electric heating apparatus. (September 13th.)

Cardiff.—October 15th. R.D.C. Electricity Department. 11-kV cables and switchgear, kiosk, and 150-kVA transformer. (See this issue.)

Carlisle.—October 21st. Electricity Department. Transformers. (September 27th.)

Cheadle and Gatley.—October 11th. U.D.C. Electric lighting and heating at showrooms in Station Road, Cheadle Hulme. R. W. Willis, engineer and manager, 37, High Street, Cheadle (deposit £1 1s.).

Cumberland.—County Council. Electric lighting in Cockermouth Secondary School, Dearham, Great Broughton, Moresby Parks, Oughterside, Egremont Central Girls' and Dalston Council Schools, Egremont Manual Instruction Centre, Millom and Lazonby police stations, Parton Crosby (Maryport), Brigham, Thursby, Crosby-on-Egremont Maternity Centre. J. Forster, County architect, 4, Alfred Street North, Carlisle.

Dover.—October 7th. Corporation. Transformer chambers. (September 13th.)

Dumbarton.—County Council. Heating and electrical work at school extension schemes. Applications to J. Weekes, County architect, 18, Park Circus, Glasgow, by October 5th.

Ealing.—October 8th. Electricity Department. Mercury-vapour street-lighting units, complete with standards. (September 27th.)

Egypt.—CAIRO.—November 2nd. Ministry of the Interior. Diesel generating plant for the Damietta power station. (T.Y. 10138.)*
November 7th. L.c. armoured cable, l.p. switchgear, insulators and pole line hardware for El Arish. (T.Y. 10136.)*
November 25th. Electrical measuring instruments for the Damanhour power station. (T.Y. 10135.)*

Epsom & Ewell.—October 14th. Electricity Department. Street-lighting standards and bracket fittings. (See this issue.)

Folkestone.—October 5th. Town Council. Wiring thirty-two houses on the Hill Road estate. (September 27th.)

Gloucester.—Electricity Department. Meters and paper insulated cable. (September 27th.)

Ilford.—October 4th. Electricity Department. Three 500-kVA transformers with tap-changing equipment. (September 27th.)

India.—October 14th. Bombay, Baroda and Central India Railway Co. Insulators and insulator fittings, line fittings and switches. (September 27th.)

Irish Free State.—DUBLIN.—October 25th. Electricity Supply Board. 25,000-kVA, 5/38-kV transformer. (September 20th.)
MAGHERAFELT.—October 10th. Board of Guardians of the Magherafelt Union. Installation of wiring for electric lighting in the workhouse, infirmary and fever hospital. J. A. Higgins, clerk of the Union.

Lanark.—County Council. Electric lighting, and other works, at Bellshill Maternity Hospital, Medical Officer's House, &c. Applications to J. Stewart, County architect, 32-36, Albion Street, Motherwell, by October 5th.

Leyton.—October 7th. Electricity Department. Cable. (September 20th.)

Liverpool.—October 7th. Corporation. Tramcar trucks, electrical equipment, &c. (September 27th.)

London.—October 10th. Commissioners of His Majesty's Works. Electric wire and cable. Controller of supplies, H.M. Office of Works, King Charles Street, S.W.1.

POPLAR.—October 16th. Borough Council. Cable. (See this issue.)

Manchester.—October 11th. Electricity Committee. Chlorination plant for circulating water. (September 27th.)
October 18th. A.c. electric fan motors. (See this issue.)

Marlborough.—October 16th. Electricity Department. Cables, protective tiles, joint boxes, service connections, fuseboards and accessories, l.p. overhead linework on wood poles, and transformers. (See this issue.)

Middlesbrough.—October 7th. Electricity Department. 1,054 yd. of p.i. l.c. cable. Preston Kitchen, town clerk, Municipal Buildings.

Neston (WIRRAL).—October 7th. U.D.C. Electrically driven centrifugal water pump with automatic switch control gear and pipework and one venturi meter tube, with clock, seven-day diagram and counter recorder. A. Tillotson, Town Hall (deposit £1 1s.).

New Zealand.—CHRISTCHURCH.—October 15th. Municipal Electricity Department. Twelve 200-kVA single-phase, oil-immersed indoor type transformers. (T.Y. 10095.)*
INVERCARGILL.—November 4th. City Council. Supply of 660-V and 11,000-V paper-insulated, lead-covered, steel tape armoured cables. (T.Y. 10100.)*
November 4th. Tramways and Electricity Department. One single-panel h.v. cubicle and one 6-unit l.v. ironclad switchboard. (T.Y. 10012.)*
WELLINGTON.—November 25th. Posts and Telegraph Department. Ammeters, voltmeters and high- and low-voltage relays. (T.Y. 10127.)*
January 14th, 1936. Public Works Department. Three 1,667-kVA oil-immersed, self-cooled outdoor single-phase transformers. (T.Y. 10060.)*
AUCKLAND.—October 14th. 250 three-plate electric cooking ranges and, alternatively, 500 cooking ranges. (T.Y. 10122.)*
DUNEDIN.—December 9th. City Corporation. One 7,500-kVA, 6,600-V, three-phase, 50-cycle, totally enclosed, self-ventilating synchronous condenser. (T.Y. 10124.)*

Norwich.—Electricity Department. Street-lighting lanterns, brackets and standards. (September 27th.)

Reigate.—October 16th. Borough Council. Electric storage heaters at Redhill fire and police stations. (See this issue.)

Royton.—October 7th. U.D.C. Electric lighting and power at seventy houses on the Stottfield housing site. Surveyor's Office, Town Hall.

Sheffield.—Electricity Department. October 11th. Five 450-kVA three-phase outdoor transformers. (September 27th.)

South Africa.—CAPE TOWN.—November 6th. Electricity Department. Two horizontal spindle, electrically driven centrifugal sewage pumps, with motors, piping, &c. (T.Y. 5323.)*

Swansea.—October 18th. Electricity Department. Interior and exterior lighting installations, heating circuits, &c., at Tir John power station. (September 27th.)

Uruguay.—MONTEVIDEO.—November 4th. State Electricity Supply and Telephone Administration. 300,000 metres of paper and compound insulated cotton covered and braided Hackethal type wire and cable. (T.Y. 10103.)*
November 25th. 75,000 40-W, 225-V, and 1,500 500-W, 225-V electric lamps. (T.Y. 10137.)*

Washington (Co. DURHAM).—October 14th. U.D.C. Twenty-eight electric discharge street lamps on existing networks in the district. R. J. Swaddle, surveyor, Council Offices (deposit £1 1s.).

Willesden.—October 9th. Middlesex County Council. Electric lighting, power, ward and staff signalling installations in two ward blocks, Central Middlesex County Hospital. (September 20th.)

---

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Barking.—Education Committee. Accepted. Electric lighting installation at Manor School (£1,226).—G. W. Day & Co., Ltd.
Electricity Committee. Accepted. Feeder panel extension (£126).—A. Reyrolle & Co., Ltd.

Boxhill.—Electricity Committee. Accepted. Cable for twelve months.—Telegraph Construction & Maintenance Co., Ltd. Conversion of wireless apparatus, &c., in connection with the change-over (£717).—Radiomenders, Ltd.

Croydon.—Electricity Committee. Recommended. Four switch feeder panels (£738).—A. Reyrolle & Co., Ltd. Turbo-alternator (£75,948) and switchgear, transformer, &c. (£9,872).—Metropolitan-Vickers Electrical Co., Ltd. Condensing plant (£23,285) and circulating pipes, &c. (£5,600).—Hick, Hargreaves & Co., Ltd.

Durham.—County Education Committee. Accepted. Electrical installations in schools, &c.: Oakenshaw C.S. (£114), Frosterley South C.S. (£40), and Spennymoor Alderman Wraith C.S. (£463).—E. Robson, Willington. Dawdon C.S. (£223).—T. B. Watson & Sons, Stockton. Dunston C.S. (£253).—R. W. Leek & Co., Newcastle-upon-Tyne. Blaydon School Clinic and Child Welfare Centre (£118).—J. Mayo, Newcastle-upon-Tyne.

East Ham.—Electricity Committee. Accepted. 500-kVA transformer (£252) and 500-kVA delta-diametric transformer (£289).—English Electric Co., Ltd. Switchgear (£210).—Switchgear & Cowans, Ltd. House-service boxes for twelve months.—W. T. Henley's Telegraph Works Co., Ltd.

Glasgow.—Education Committee. Accepted. Electrical work at Crosshill school (£1,243).—D. A. McLarty & Co., Ltd.
Housing Committee. Accepted. Electrical installation in 232 houses on the Blochairn housing scheme (£932) and 136 houses on the Hillington Park No. 1 housing scheme (£534).—Darroch & Espie, Glasgow.
Transport Committee. Accepted. L.c. cable.—Craigpark Electric Cable Co., Ltd.

Grange.—U.D.C. E.h.p. feeders, with transformer kiosks and feeder switchgear.—Johnson & Phillips, Ltd. (£1,531); Switchgear & Cowans, Ltd. (£176).

Liverpool.—Passenger Transport Committee. Accepted. Plant for new tramcars: Fifty car sets of bogie trucks, including brakes (£532 per set).—Electro-Mechanical Brake Co., Ltd.

Fifty car sets of electrical equipment, including four motors complete for each car (£560 per set).—General Electric Co., Ltd. Fifty sets of control gear, including controllers, resistances, circuit-breakers, &c. (£283 per set).—Metropolitan-Vickers Electrical Co., Ltd.

London.—HACKNEY.—Works Committee. Accepted. Two electric vehicle batteries (£464).—Chloride Electrical Storage Co., Ltd.

POPLAR.—Contracts Committee. Accepted. Two 500-kVA transformers (£357).—Johnson & Phillips, Ltd. Switchboard (£147).—English Electric Co., Ltd. Switchgear (£622).—Metropolitan-Vickers Electrical Co., Ltd. Electric show van (£267). —Bonnalack & Sons.

Manchester.—Electricity Committee. Recommended. 50,000-kW turbo-alternator, 1,500-kW house service generator, condenser and auxiliary plant for Barton power station, and supervisory control gear for Benchill sub-station.—Metropolitan-Vickers Electrical Co., Ltd. 33,000-V switchgear reconstruction at Stuart Street and Main transformer sub-stations, and 6,600-V switchgear at Oldham Road "B" sub-station.—A. Reyrolle & Co., Ltd. 6,600-V switchgear at High Street sub-station.—British Thomson-Houston Co., Ltd. Sub-contractors for ammeters.—Metropolitan-Vickers Electrical Co., Ltd.

Salford.—Electricity Committee. Recommended. Electric vehicle (£898).—Electricars, Ltd.

Sheffield.—Electricity Committee. Accepted. Two panels for the installation of two electric furnaces (£233).—A. Reyrolle & Co., Ltd.

Slough.—U.D.C. Accepted. Electrical installations in 242 houses in the 1919 (Stoke Poges Lane, &c.) scheme (£900).—Everything Electrical, Ltd.

South Shields.—Town Council. Accepted. Electrical installation in 328 houses in Prince Edward Road.—Harrison Bros., Seaham Harbour.

Stoke-on-Trent.—Housing Committee. Accepted. Electric wiring and fittings at fifty-six houses at Abbey Hulton (£216) and 153 houses at Meir (£549).—Edston Electric.

Health Committee. Accepted. Electrical installation at Tuberculosis Dispensary (£223).—Barnett & Soans.

Electricity Committee. Accepted. Electric cookers.—General Electric Co., Ltd.; Jackson Electric Stove Co., Ltd.; Revo Electric Co., Ltd.

Warrington.—Electricity Committee. Accepted. Sub-station switchgear.—Ferguson, Pailin, Ltd.

Wimbledon.—Electricity Committee. Accepted. Telephone installation in new Electricity Offices (£268).—Siemens Bros. & Co., Ltd.

Forthcoming Events

Electrical Power Engineers' Association (*Southern Division*). —Saturday, October 5th. Holborn Restaurant, W.C.1. 5.30 for 6 p.m. Annual dinner.

Batti-Wallahs' Society.—Tuesday, October 8th. Hotel Metropole, W.C.2. 12.30 for 12.55 p.m. Luncheon. Address by Mr. F. Gill.

Illuminating Engineering Society.—Tuesday, October 8th. Lighting Service Bureau, W.C.2. 4.30 p.m. Presidential address by Mr. A. W. Beuttell.

Institution of Engineers and Shipbuilders in Scotland.—Tuesday, October 8th. Presidential address by Prof. P. A. Hillhouse. Friday, October 11th. "James Watt" dinner.

Electrical Association for Women.—Wednesday, October 9th. Criterion Restaurant, W.1. 1 p.m. Luncheon. Address by Mr. J. C. Dalton. (*Demonstrators' Circle*).—Monday, October 7th. 20, Regent Street, S.W.1. 7.30 p.m. General meeting.

Institution of Engineers-in-Charge.—Wednesday, October 9th. St. Bride Institute, E.C.4. 7.30 p.m. "Plant Pipework and Fittings." Mr. A. G. Bugden.

Institute of Fuel.—Wednesday, October 9th. Annual dinner and dance.

Television Society.—Wednesday, October 9th. University College, W.C.1. 7 p.m. "Television at the Berlin Radio Exhibition, 1935." Mr. E. H. Traub.

Notes

The I.M.E.A. Annual Convention

We are officially informed that the fortieth annual convention of the Incorporated Municipal Electrical Association will be held in Edinburgh during the week commencing June 8th, 1936.

We understand from the Electrical Contractors' Association that the form which its annual meeting will take next year has not yet been settled. The Council has called for a report which will be considered at its next meeting.

Fatalities

An inquest was held last week at Audenshaw, near Manchester, on a man who died from electric shock while working beneath the floor of a house at Audenshaw. Investigations after the tragedy revealed that the braid covering a portion of the electric cable had frayed and when the iron conduit through which the cable passed was moved, electrical contact was created. The earth wire was also found to be broken from the clip on a water pipe. Electrical experts from Manchester Corporation, which supplies electricity to Audenshaw, said they were of opinion that when the workman went through the small trapdoor beneath the floorboards he broke the earth wire with his foot. If the earth wire had not been broken the fuse would have blown when contact was made with the conduit and the tragedy would not have occurred. The coroner expressed his disapproval of the fact that after the tragedy the electric cable, the portion of conduit, and the earthing clip were all removed, so that when he visited the house on the night of the tragedy all the evidence was missing. A verdict of "Accidental Death" was returned.

At an inquest held in Sheffield on Mrs. Irene Frost last week the husband of the deceased said that he had connected an electric radiator, after testing, to the electric light circuit in the bathroom by means of a two-way adaptor, placing it on a shelf above the hand basin, well away from the bath. One night last week he found his wife lying unconscious in the bath; the radiator was dangling in the water from the flex, part of which was under the water. He thought his wife had connected the adaptor herself and had put the radiator on the window-ledge, from which it had fallen. A doctor said the cause of death was electric shock and not drowning; artificial respiration had been applied for some considerable time. Mr. A. C. Bostel, consumption and sales engineer, Sheffield Corporation Electricity Department, said that it was inadvisable, in any circumstances, to use an electric fire in a bathroom within reach of any person in the bath. Advice was given to all consumers accordingly. While the radiator was in the water there was little danger of getting a shock, but it was his opinion that the deceased got hold of a metal part to lift it out of the water.

Mr. Bostel referred to the regulation (supplied to every prospective consumer) that nothing should be connected to an electrical installation unless the Electricity Department had been previously advised. A verdict of "Accidental Death" was recorded.

I.E.E. Transmission Section Conversazione

The annual conversazione of the Transmission Section of the Institution of Electrical Engineers will take place on November 1st in Harrod's Georgian Restaurant. Following the reception by the chairman, Mr. W. Fennell, there will be dancing with an interval for supper and an exhibition of overhead line equipment is also being arranged. Tickets (12s. 6d. per person) are obtainable from the Secretary, Institution of Electrical Engineers, Savoy Place, Victoria Embankment, W.C.2.

High-definition Television

In accordance with the terms of their contracts with the B.B.C., Baird Television, Ltd., and the Marconi-E.M.I. Television Co., Ltd., have issued specifications of the wave-forms to be radiated on the two companies' systems when the B.B.C. inaugurates its new high-definition television service from the Alexandra Palace, London, where plant is now being installed. This information is being made available to enable manufacturers to design television receivers. It includes details of the signals to be employed, together with graphical representations and dimensions of the wave-forms to be transmitted by the two systems.

The Exhibition of Inventions

An automatic thermostatically controlled electric toaster which switches itself off when the toast is made, an organ utilising electrical tone production, and a radio set incorporated in a table drawer are three of the interesting items at the International Exhibition of Inventions now being held at the Central Hall, Westminster. Other electrical exhibits in the New Inventions Section include a device for topping accumulators automatically, photo-sculpture apparatus, one-piece lampshades needing no wire frame, an automatically locking lampholder, anti-dazzle devices, a cyclist's arm indicator, a vibratory pad, a miner's safety lamp fuse bulb, the "Zonograph" self-calibrating radio dial, a radio-gramophone record changer, an industrial speed checker, a playing-card dealer, and a central vacuum-cleaning scheme. A special exhibit by Major Raymond Phillips comprises an "Auragraph" for recording the effect of human aura, apparatus for switching off unwanted radio programmes without mechanical or other connections, and an "electric eye" for controlling pedestrian crossings. Messrs. Siemens Bros. & Co., Ltd., have lent samples of self-regulating soil-heating cable, a "Neophone" high-speed relay switch transmitter in parts, telephone instruments and relays, while other trade exhibits are shown by the Ideal Home Electrical Appliances, Ltd. (health appliances); Fortiphone, Ltd. (deafness aids); Key Burglar Alarm (Scotland), Ltd.; and B. Szeps ("Plastocotta" lampshades). The exhibition will remain open until October 12th.

Appointments Vacant

Electrical engineer for Portland U.D.C. (salary £300 rising to £400).

Assistant to chief engineer for the Georgetown (British Guiana) Sewerage and Water Commissioners.

Chief electrical engineer for the Gold Coast Government Railway. (Salary £840, rising to £920 per annum.)

Electrical engineer and manager (£850, rising to £1,000 per annum) for Bethnal Green Borough Council.

Sub-station charge engineer for East Ham Electricity Department.

Two assistant engineers for the N.I. Electricity Board.

(See our classified advertisements.)

Makers' Names Wanted

MAGIC electric blanket.

SANAX vibratory massage outfit.

ARK fuse wire on cards.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

A short time ago **Sir William Ray,** Executive Chairman of the Electrical Development Association, was granted three months' leave of absence on medical grounds and he went to the South of France to recuperate. In its issue of September 26th, the *Advertiser's Weekly* stated, "on reliable authority," that Sir William was shortly resigning his position because of ill health. Inquiries made by us at the moment of going to press have failed to furnish confirmation of the report.

Mr. O. Howarth, of the Lancashire Electric Power Co., has been elected chairman of the Meter and Instrument Section of the Institution of Electrical Engineers for the ensuing session in the place of Mr. W. Holmes, whose death is recorded in our "Obituary" section.

Lt.-Comdr. R. Berkley Fairthorne, R.N. (Ret.), A.M.I.E.E., A.M.I.Mech.E., has removed from 6, Queen Anne's Gate, London, S.W., where he was formerly partner in a firm of consultants, to "Greenacre," Higher Denham, Bucks (Tel.: 118 Denham).

Dr. Dugald C. Jackson, professor emeritus and honorary lecturer in electrical engineering, Massachusetts Institute of Technology, and past-president of the American Institute of Electrical Engineers, was, according to the *Electrical World*, to leave the United States early this month to deliver a course of lectures in Japan under the Iwadare Foundation.

Sir John Cadman, G.C.M.G., D.Sc., the president-elect of the Institute of Fuel, will be installed in the presidential chair by the outgoing president, Sir Harry McGowan, K.B.E., on October 9th, and will deliver his address.

Mr. H. R. Ricardo, F.R.S., has been nominated as the Melchett Medallist of the Institute of Fuel for the year 1935. Mr. Ricardo will deliver the Melchett Lecture on October 9th.

Mr. R. W. L. Phillips, borough electrical engineer of Bedford, has had his salary increased to £1,570 per annum. For the purposes of superannuation the salary has been stabilised at this sum until October 25th, 1937, when Mr. Phillips attains the age of sixty-five.

Mr. J. W. Williams, borough electrical engineer of Wrexham, has been recommended by the Electricity Committee for an increase in salary from £550 to £600 per annum as from July 1st last.

Mr. G. P. Dennis, of Birkenhead, who has been elected president of the Liverpool Devonian Society, is the principal of Messrs. G. P. Dennis & Co., electrical merchants of Liverpool and Hooton. He is a member of the Institution of Electrical Engineers, and was for many years head lecturer in the Electrical Engineering Department of the Liverpool Central Technical College. He represented the Lancashire and Yorkshire Section of the Electrical Wholesalers' Federation in London for six years and was president in 1926.

Mr. E. S. Hall, A.M.I.E.E., of the research laboratory staff of the British Thomson-Houston Co., Ltd., at Rugby, who was recently married at Newbold-on-Avon to Miss P. E. Smith, has received electrical gifts from his colleagues.

Sir Cyril Hurcomb, K.B.E., C.B., will be inducted as president of the Institute of Transport at the first ordinary meeting of the Institute of the session 1935-36, which will take place at the Institution of Electrical Engineers on October 14th.

Mr. G. Wansbrough has been elected a director of the British Power & Light Corporation, Ltd.

Obituary

Mr. G. Porter.—We regret to record the death of Mr. Geoffrey Porter, borough electrical engineer of Worthing, on September 26th at the age of 61. He was operated upon on the previous Saturday for appendicitis, and was making good progress when heart trouble developed. Mr. Porter received his technical training in Germany, and on leaving Berlin he entered the service of the P. & O. Steam Navigation Co., with whom he remained for about two years. In 1897 he was appointed to the staff of the Westminster Electric Supply Corporation, Ltd., where he gained considerable experience at the old power stations at Eccleston Place and Davis Street. He went to Worthing in 1901 as resident electrical engineer during the construction of the power station, and when supply was commenced was appointed borough electrical engineer. He was one of the founders of the Diesel Engine Users' Association and had served four times as its president. He was the author of a number of papers on heavy-oil engine practice, and had read papers on the subject before the Diesel Engine Users' Association, the I.M.E.A., and at the Centenary Congress of the Institution of Civil Engineers. He became a member of the I.M.E.A. in 1914; he was elected to the Council in 1926, and was president during the year 1932-33. For several years he served on the sub-committee for Internal Combustion Engines of the Prime Mover Committee of the British Standards Institution, and during the War was a member of the Heavy-Oil Engine Fuel Committee appointed by the Ministry of Munitions. He was also a member of the National Consultative and the South-East England Consultative Committees of the Central Electricity Board.

[Elec. Rev. photo
The late Mr. Geoffrey Porter

The funeral service at St. Paul's Church, Worthing, on Monday, was attended by the Mayor and Corporation, the chiefs of various departments, and practically the whole staff of the Electricity Department, including Mr. E. G. Staygle, deputy borough electrical engineer, and Mr. Wiggans, consumers' engineer. Others present were representatives of the I.M.E.A., the Diesel Engine Users' Association, the E.C.A., the Association of Municipal Electrical Engineers, the B.E.A.M.A., and a number of well-known borough electrical engineers and contractors. Mr. Geoffrey Porter leaves a widow, a son and a daughter, with whom great sympathy is felt in their sudden loss.

Mr. R. S. McLeod, M.I.E.E., whose death was recorded in our last issue, was one of the original staff of the Lancashire Dynamo & Motor Co., Ltd. (now Lancashire Dynamo & Crypto, Ltd.); he was chief engineer for about twenty-seven years,

The group at the opening of the Blackburn Electrical Exhibition (see page 447). Among those present were Messrs. C. T. S. Arnott (C.E.B.), P. J. Robinson (city electrical engineer, Liverpool), C. G. Morley New (Electricity Commissioner), Ald. C. A. Critchley (Mayor of Blackburn and chairman of the Electricity Committee), and Mr. R. H. Harral (borough electrical engineer, Blackburn)

and, for ten years until he retired in 1927, a director of that company. He was mainly responsible for the design of the electrical machinery, for which the company became so well known. The Turnbull-McLeod automatic reversible booster, the Lancashire planer gear, and the Maxtorq motor, were developed by him, or under his supervision. He served on the B.E.A.M.A. Standards Committee until he retired, and during the War was on the Manchester Anti-submarine Committee. The funeral took place on September 26th at the West Norwood Crematorium.

Mr. W. Holmes.—We regret to record the death of Mr. Wilfred Holmes, manager of the Instrument Department of Messrs. Ferranti, Ltd., at the age of fifty-eight years. Mr. Holmes appeared to have made a good recovery from a serious illness early in the year, but last week he suffered a relapse and died on Saturday morning. He received his technical education in mechanical engineering at Ashton-under-Lyne with practical training in heavy mechanical engineering, and was King's Prize winner at the Manchester College of Technology; further studies in electrical engineering he pursued at Owen's College, Manchester. He joined the staff of Messrs. Ferranti, Ltd., in 1903 to help in the development of a.c. meters, and afterwards became chief technical engineer to the Meter Department. In 1926 he was appointed manager of the Instrument Department, and controlled the design and manufacture of special metering gear supplied to the C.E.B. His activities in connection with synchronous clocks and small synchronous motors are well known. Mr. Holmes was a trusted assistant and friend of the late Dr. S. Z. de Ferranti in meter, instrument and other apparatus matters. He was a valued contributor to the ELECTRICAL REVIEW, and had read various papers before the Institution of Electrical Engineers. He also served on several committees of the British Standards Institution. He was one of the most active members of the Meter and Instrument Section of the I.E.E. from its inception, and had been elected to the office of chairman for the coming session. Mr. Holmes's death comes as a great loss to the Ferranti staff, and deep smypathy is felt for Mrs. Holmes and her son and daughter.

The late Mr. W. Holmes

Mr. C. S. Northcote.—The death occurred a few days ago of Mr. C. S. Northcote, who was many years ago prominently connected with the electrical trade in Manchester and in London. In the 'nineties of last century he was manager of the contracting department of Messrs. Veritys, Ltd., and amongst other work carried out during his period there he was responsible on behalf of that company for the Blackpool Winter Gardens installation. He was later transferred to London, where he managed the company's accessories business. When the original electrical manufacturers' association was formed he took a considerable part with others in its early work and discussions. After leaving Messrs. Veritys he acted as joint manager, with the late Mr. Davenport, of the electrical exhibition which was held at Rusholme, Manchester.

Subsequently Mr. Northcote began business operations on his own account as Wholesale Electric Traders, a concern which aimed at carrying on what was termed a "co-operative" buying business from which electricity supply authorities were to purchase supplies of goods in bulk at very favourable prices. The scheme excited much discussion, and the "Correspondence" pages of the ELECTRICAL REVIEW for some weeks contained many opinions reviewing the proposition from the standpoints of different interests. The plan did not succeed, and other efforts made by him from time to time were also unsuccessful. For various reasons good fortune failed to smile upon his enterprises. Later Mr. Northcote's health failed, and for many years past he has lived more or less a life of seclusion, but electrical men who knew him in the early years will remember him as a man of great ambition, restless activity and no mean ability. Writing from memory we should say that he was about seventy years of age at the time of his death.

Mr. W. K.-L. Dickson.—The death is announced in *The Times* of Mr. William Kennedy-Laurie Dickson, F.R.G.S., A.M.I.E.E., which occurred at Twickenham on September 28th. Mr. Dickson, who was seventy-three years of age, was in his earlier days associated with Edison in the United States. In later years he had acted as a consulting engineer with a private research laboratory. He became an associate member of the Institution of Electrical Engineers in 1909.

Mr. C. J. Collis.—The death is announced at the age of sixty-five years of Mr. Charles John Collis, of 43, Gilmore Road, Lewisham, London, S.E., who, until his retirement last June, was chief electrical engineer at the Surrey Docks (Port of London Authority). He was originally in the telephone service.

Mr. H. Harold.—The death occurred on September 24th, at his home at Dartmouth, of Mr. Herbert Harold, manager of the Dartmouth branch of the Urban Electric Supply Co., Ltd. Mr. Harold, who was forty-nine years of age, was a native of Redruth, and joined the Dartmouth staff of the Urban Electric Supply Co. over thirty years ago.

The Hon. Lionel Guest, who died on September 27th, at the age of fifty-five, was a director of Hall Telephone Accessories (1928), Ltd.

Will.—Mr. Harry Buchanan, a governing director of Messrs. Buchanan & Curwen, Ltd., left £9,878 (net personalty £8,888).

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Submarine Cables, Ltd.—Details of the registration of this company appear on page 445.

Henley Extrusion Machine Co., Ltd.—Registered as a private company September 27th. Nominal capital £20,000 in £1 shares (10,000 "A" and 10,000 "B"). The "A" shares shall be allotted to W. T. Henley's Telegraph Works Co., Ltd., or their nominees, against payment therefor in cash at par. Objects: To acquire from W. T. Henley's Telegraph Works Co., Ltd., certain letters patent for inventions relating to the manufacture of an extrusion machine, and to carry on the business of ironfounders, mechanical engineers, tool makers, brassfounders, electrical engineers, &c. The first directors are Sir Montague Hughman, W. F. Bishop, W. Travis, P. V. Hunter, and B. Welbourn. So long as W. T. Henley's Telegraph Works Co., Ltd. (or its nominees) holds the majority of the "A" shares it may nominate two directors. Sir Montague Hughman and W. F. Bishop are the first nominees. The holders of a majority of the "B" shares may nominate three directors, W. Travis, P. V. Hunter and B. Welbourn being the first nominees. Registered office: 11, Holborn Viaduct, E.C.1.

Electrical and Radio Installations Co. (Surrey), Ltd.—Private company. Registered September 28th. Capital, £1,000 in £1 shares. Objects: To acquire the business carried on by S. E. Weeden, at 5, Caldbeck Parade, Worcester Park, and at 5, Stoneleigh Parade, Stoneleigh Park Road, Ewell, Surrey, and to carry on the business of electrical, radio and television engineers, &c. The directors are: S. E. Weeden, 62, Lynwood Drive, Worcester Park, and one other. Secretary: W. R. Swift. Registered office: 5, Caldbeck Parade, Worcester Park.

Lee & Plunkett, Ltd.—Private company. Registered September 26th. Capital, £500 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers and manufacturers of all kinds of electrical apparatus and appliances, &c. The first directors are: R. E. Lee, 70, King's Close, Hendon, N.W.4; and A. E. Plunkett, 20, Hillier Close, County Gate, Barnet.

G. A. Ryland's Electrical and Engineering Co., Ltd.—Private company. Registered September 25th. Capital, £10,000 in £1 shares. Objects: To carry on the business of manufacturers, merchants, repairers and reconditioners of and dealers in electrical switchgear, motors, dynamos, alternators, equipment for complete power stations, steam turbine plant, &c. The provisional directors are: G. A. Ryland, Hillboro', Kinver, Staffs; and T. Clare, Midland Bank Chambers, Brierley Hill. Solicitors: Higgs & Sons, 92, High Street, Brierley Hill.

Alfred Diggle & Co., Ltd.—Private company. Registered September 21st. Capital £2,000 in £1 shares. Objects: To acquire the business of a manufacturing, electrical and mechanical engineer now carried on by Wilfred Diggle at Reliance Works, Jane Street, Rochdale, as "Alfred Diggle & Co.," and to carry on the business of manufacturing, electrical and mechanical engineers, manufacturers, repairers, importers and exporters of and dealers in dynamos, motors, batteries, &c. The first director is W. Diggle, Knowle View, 19, Chester Avenue, Bamford, Lancs.

Butcher, Smith & Co., Ltd.—Private company. Registered September 23rd. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of or dealers in electric batteries, accumulators, electrical goods and equipment, radio equipment, &c. The first directors are: D. S. S. Butcher, 13, Luxemburg Gardens, Hammersmith, W.6 and V. A. Smith, 49, Copthall Gardens, Twickenham, Middlesex. Registered office: 3 and 5, Park Road, Teddington, Middlesex.

C. H. Richards & Co. (Accessories), Ltd.—Private company. Registered September 27th. Capital, £1,200 in 1,000 6 per cent. preference shares of £1 each and 4,000 ordinary shares of 1s.

each. Objects: To acquire from S. C. Caddy, of 76, Broadwater Road, Worthing, a licence to manufacture, vend and sell the whole of the rights in patents Nos. 387574 and 402869 of an invention for improvements relating to reflex lights and electric incandescent lamps, and to carry on the business of motor-car and motor-cycle accessory manufacturers, &c. The first directors are: C. H. Richards, First Avenue House, Holborn, W.C.1, and one other. Registered office: First Avenue House, Holborn, W.C.1.

Returns of Electrical Companies

Bailey & Incledon, Ltd. (Old company).—E. V. Weller, 25, Haymarket, S.W.1, ceased to act as receiver on September 20th, 1935.

Willans & Robinson, Ltd.—Satisfaction in full on August 12th, 1935, of trust deed dated May 23rd, 1902, and registered June 9th, 1902, securing £250,000 debenture stock. (Notice filed September 19th, 1935.)

Spanish Power Syndicate, Ltd.—Capital, £10,000 in 5,000 preferred ordinary shares of £1 and 100,000 deferred ordinary shares of 1s. Return dated December 31st, 1934 (filed March 9th, 1935). 4,950 preferred ordinary and 100,000 deferred ordinary shares taken up. £4,553 paid on preferred ordinary shares, leaving £397 calls unpaid. £5,000 considered as paid on the deferred ordinary shares. Mortgages and charges, nil.

Wellingborough Electric Supply Co., Ltd.—Capital, £50,000 in £10 shares. Return dated April 23rd, 1935. All shares taken up. £50,000 paid. Mortgages and charges, £45,000.

United Telephone Cables, Ltd.—Capital, £1,000 in £1 shares. Return dated April 22nd, 1935. All shares taken up. £1,000 paid. Mortgages and charges, nil.

Chepstow Electric Lighting & Power Co., Ltd.—Capital, £10,000 in £1 shares. Return dated April 5th, 1935. 5,510 shares taken up. £1,605 paid. £3,905 considered as paid. Mortgages and charges, nil.

Camborne Electricity Supply Co., Ltd.—Capital, £20,000 in £1 shares. Return dated April 25th (filed May 10th), 1935. All shares taken up. £20,000 paid. Mortgages and charges, nil.

Simpson, Baker & Co., Ltd.—Capital, £20,000 in £1 shares. Return dated April 9th, 1935. All shares taken up. £20,000 paid. Mortgages and charges, nil.

Melton Mowbray Electric Light Co., Ltd.—Capital £60,000 in £5 shares. Return dated April 22nd, 1935. 9,600 shares taken up. £48,000 paid. Mortgages and charges, £19,100.

Thrissell Engineering Co., Ltd.—Capital, £150,000 in 5s. shares. Return dated April 12th (filed May 9th), 1935. 351,738 shares taken up. £40,803 5s. paid. £47,131 5s. considered as paid. Mortgages and charges, nil.

Sam Sharples, Ltd.—Capital, £1,000 in £1 shares. Return dated October 20th, 1934 (filed April 24th, 1935). 502 shares taken up. £502 paid. Mortgages and charges, nil.

New Process Welders, Ltd.—Mortgage dated September 6th, 1935, to secure £2,500 charged on freehold land with Telemol Works thereon in Hayes, Southall, Middlesex. Holder: British General Insurance Co., Ltd., 66, Cheapside, E.C.2.

Marconi International Marine Communication Co., Ltd.—Capital, £1,500,000 in £1 shares. Return dated April 26th, 1935. 1,192,726 shares taken up. £1,087,726 paid, £105,000 considered as paid. Mortgages and charges: £100.

Architectural Lighting, Ltd.—Satisfaction in full on September 4th, 1935, of charge dated May 31st, 1935, and registered June 13th, 1935. (According to the register of mortgages, the mortgage registered June 13th, 1935, orginally secured all moneys which the chargee might be called upon to pay under a guarantee not exceeding £600.)

Autocar Electrical Co., Ltd.—Capital, £5,000 in £1 shares. Return dated April 20th, 1935. All shares taken up. £5,000 paid. Mortgages and charges, nil.

City Notes

Companies to be Struck off the Register.—The names of the following companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—Bevan's Radio Supplies, Ltd.; Bowman Brothers (Radio), Ltd.; British Electrical Industries (Birmingham), Ltd.; Campbell Short Wave Wireless, Ltd.; Cannon Electrical Appliances, Ltd.; Central Radio Agencies, Ltd.; Cyntra Electric Supplies, Ltd.; Electro-Medical Circulators, Ltd.; Electro-Medical Lamps & Neon, Ltd.; H. & C. Wireless, Ltd.; Homeaids Ambilectric Radio, Ltd.; Hurtons (Electrical), Ltd.; Manor Electric, Ltd.; Modern Electric (Manchester), Ltd.; Page Car Radio, Ltd.; Radio Maintenance, Ltd.; Radio Mutual, Ltd.; Radio Supplies & Service Co. (Bristol), Ltd.; Sidcup Electrical Co., Ltd.; Wholesale Radio Supplies, Ltd.

Ericsson Telephones, Ltd., held an extraordinary meeting on September 26th at which resolutions were passed for converting the £1 ordinary shares into four stock units of 5s. each and to give each stockholder one free 5s. stock unit for every four units held. It was also decided to increase the authorised capital from £500,000 to £700,000, which would leave £124,992 of capital unissued for any future requirements. Col. Sir Harold A. Wernher (chairman), who presided, said that the company had been able to find employment for double the number of people it was employing two years ago. Within the next few weeks the directors proposed to pay an interim dividend upon the old and new stock alike.

Electric & Musical Industries, Ltd., reports a profit for the year ended September 30th last, subject to audit, of £451,002, to which is added a profit of £114,544 from the sale of investments, making a total of £565,546. The profit for the preceding year, before providing for tax, was £420,710. It is proposed to pay a dividend of 10 per cent., plus a bonus of 2½ per cent., making 12½ per cent. for the year, as against 10 per cent. for the previous year.

J. & F. Stone Lighting & Radio, Ltd., held its second annual meeting on September 26th, when Mr. J. C. Gardner (chairman), who presided, said that the accounts covered the first full year of the company's activities, although a complete comparison of the present figures with those of a year ago (when a trading period of six months only had been covered) could not be given. The turnover for the past year of those shops which had been open in July, 1933, showed an increase, while the remaining shops, opened during last year, had come well up to expectations. Of the forty-nine shops operating on June 30th last twenty-eight were in London and suburbs and twenty-one in the provinces as far north as Leeds, and since July 1st a further five new premises had been taken.

The Parsons Marine Steam Turbine Co. reports a net profit for the year ended June 30th last, after writing off expenditure on experimental, pioneer and development work, of £12,271, against £11,124 for the previous year. The dividend of 5 per cent. is to be maintained, and the sum carried forward is to be increased from £30,969 to £32,676. It has been decided to make an additional distribution of 15 per cent., free of tax, out of profits obtained by realising (since the end of the financial year) a portion of the appreciation in the company's holdings of Government securities.

Radio Central Exchanges, Ltd., reports a net profit for the year ended May 31st last of £1,929, as compared with £1,638 for the preceding nine months. No dividend is recommended, the profit being added to the sum carried forward, raising it to £2,755. All the subsidiary companies except one earned profit, which, apart from certain payments on account of fixed preference dividends, has been retained in the subsidiaries' accounts.

Philips' Incandescent Lamp Works Holding Co. proposes to pay dividends for the year to April 30th last of 11 per cent. on ordinary shares and 7 per cent. on the participating preference shares. For the sixteen months to April 30th, 1934, an ordinary dividend of 11 per cent. was paid. The same rates of dividends as those now announced will be proposed for Philips' Incandescent Lamp Co., the operating company.

The British Aluminium Co., Ltd., is paying the preference dividend for the half-year ended June 30th last, but the directors have decided to await the full year's trading results before consideration of a dividend on the ordinary shares. No interim dividend was paid on the ordinary shares last year, but the final distribution was 7½ per cent., against 5 per cent. in the preceding year.

Murex, Ltd., has declared a final dividend of 10 per cent., actual, less tax, on the ordinary shares, making 20 per cent. for the year. In addition, part of the reserves are being capitalised and a bonus issue will be distributed to shareholders of one fully-paid £1 ordinary share for every forty shares held. The shares will rank for dividend as from July 1st last.

Baird Television, Ltd., in a circular to shareholders on a proposed capital reorganisation scheme, states that prolonged consideration has been given to the best method of raising the additional capital now required, and a scheme has been prepared. This will be presented at meetings to be held on October 31st.

The India Rubber, Gutta Percha & Telegraph Works Co., Ltd., is to pay dividends of 6 per cent. on the ordinary and the preferred ordinary shares in respect of the past year. The last ordinary distribution was for 1928-29, when 2½ per cent. was paid.

Joseph Lucas, Ltd., have announced a final dividend of 10 per cent., making 12½ per cent. less tax, for the year. This is the same as for the preceding year.

Stocks and Shares

TUESDAY EVENING.

ONCE more it has to be written that the Stock Exchange markets are at the mercy of the various political currents which continue to change from day to day; sometimes, it would seem, from hour to hour. In the early part of the week, the tentative approach made by Mussolini to the British Government was read as being something in the nature of an olive branch, though its effect was neutralised by a Franco-British interchange of "enquiries." Throughout the protracted negotiations of the past few weeks, many people maintained their opinion that no outbreak of war would occur and that confidence in the outlook would prove to be justified by the turn of events. This week, however, optimism has been very subdued. The uncertainty lies heavily upon Stock Exchange markets and prices alike. The prophesied autumn boom has yet to materialise. Reference to our price lists will show that movements are somewhat mixed. There has been a pronounced recovery amongst shares in the companies concerned with manufacturing and equipment. One of the most interesting announcements refers to the amalgamation of the gutta-percha insulated submarine cable interests of Siemens Bros. & Co. with those of the Telegraph Construction & Maintenance Co.

Gilt-edged Stocks

Apart from a decline of a point in London Passenger Transport "B" stock to 126½, no further falls have taken place in the fixed-interest securities of this group. Capital is still shy of venturing into a market that is so liable to be influenced by day-to-day events. Central Electricity issues can be bought to pay £4 7s. outright, with a redemption yield of £3 13s. per cent. The Board's 3½ per cent. stock, dated May 1974-94, is on offer at 99, yielding 3½ per cent. outright and to redemption. London Electric Transport guaranteed 2½ per cent. stock has recovered a trifle after its drop to 94. A line is on offer at 96, giving £2 12s. per cent. now and, assuming redemption

at 100 in 1955, about 2¾ per cent. The first interest payment is one of 11s. per cent., due on February 1st next year. London Passenger Transport "C" stock at 101 shows a gain of a point. The Southern Railway announces that a number of newly electrified lines on its system have just been brought into operation.

Electricity Supply Shares

London Associated Electricity ordinary have risen 1s. 9d. to 33s. 9d. This makes a very fair criterion of the more confident condition of investment prevailing in the markets for front-rank ordinary shares. County of London ordinary are up sixpence and City of London are sixpence down, at 53s. 6d. and 37s. 6d. respectively. Metropolitans, another important member of the outside group, continue weak at 51s. Clyde Valley shares have recovered to 41s. Fluctuations in the shares of the provincial electricity supply companies are of no great consequence. Northamptons went back to 50s., at which price the yield on the money is 4 per cent., assuming the dividend to be, as it is now, 10 per cent.

British Power & Light at 29s. 6d. show 1s. gain. Palestine "A" shares have further improved to 48s. Victoria Falls ordinary have started to recover; the price is 2s. 6d. better at 67s. 6d.

Cable and Wireless

The fall in Cable & Wireless stocks, due to disappointment with the last-published monthly traffic, has been checked. The preference is dull at 95¼, but the "A" ordinary rallied to 23. Speculative stocks are unusually sensitive, however, to political influences and it takes little selling to put down prices abruptly. Globe Telegraph & Trust preference have gone back to 13½. Cables Investment Trust 3½ per cent. debenture at 99, and 4½ per cent. preference shares at 10½ are a trifle lower. American Telephone & Telegraphs at 143½ have gained 2, the Wall Street operators taking a fairly cheerful view of the prospects for business. Every now and then New York suffers from a spasm of weakness that is attributed to the shadow of European politics.

Manufacturing and Equipment

General Electrics are a better market at 3½, recovering the decline of a week ago. Ericsson Telephones shares at 7 1/16 are 3/16 better. British Insulated keep steady at 4⅜, Henleys at 6 1/16. A rise of ½ in Crompton Parkinson ordinary lifted the price to 70s. Associated Electrical Industries improved to 34s. 6d. A small decline occurred in Brush ordinary. English Electrics look much better after their fall of a week ago. The market in electrical and cable equipment shares is, on the whole, in a more satisfactory condition than was the case this time last week. Money is coming back again into the shares.

There is, generally speaking, rather more readiness on the part of the public to buy the ordinary shares in the best class industrial companies. The dividend and bonus, 12½ per cent. altogether, on Electric and Musical Industries shares had comparatively little effect upon the price. This is now 26s. 6d. A definite statement in the fairly early future is looked for in connection with television development. Meanwhile the market in television shares is quiet. The India Rubber, Gutta Percha & Telegraph Works has resumed dividend payments on its ordinary and preferred ordinary shares. Nothing has been paid on the ordinary since 1929. The company's 5½ per cent. preference shares can be bought at about 22s. 6d.

Telegraph Construction and Siemens

For several weeks past very vague rumours have been afloat as to some kind of arrangement said to be on foot between Siemens and the Telegraph Construction Company. Nobody seemed to know what was, colloquially speaking, in the wind, but the advice went round that it might be wrong to be "out of" shares in either company. The amalgamation of the gutta-percha submarine cable business of the two undertakings is considered to be a good move from the point of view of the shareholders. The principal benefit will be, according to market opinion, elimination of the competition between the two; and, by the substitution of mutual agreement, to give the companies a better chance of profitable working. The Telegraph Construction Co. has paid no dividend on its ordinary shares since these were converted to their present nominal value of £1, but Siemens paid 4 per cent. last year, against 6½ per cent. in the previous twelve months. The market effect was to raise the prices of the shares to the common level of 23s. 9d.

Coal and Electricity

Private advices concerning the labour troubles in the coal trade suggest that the demands of the men for some additional pay are not considered entirely unjustified. Apparently the difficulty centres upon the selling prices of coal. Those at present charged for domestic coal are deemed to be high. (Any householder will admit as much). To advance these prices might curtail the purchases of the private buyer. The class of coal used by electrical and other such customers is charged at a rate which, according to certain people, could stand being raised without infliction of hardship upon consumers. Were this scale to be advanced, the men could be paid more wages. And here, according to telephoned information from several large coalfields, the crux of the matter lies.

Share List of Electrical Companies

	Nom.	Dividend 1933.	Dividend 1934.	Price Oct. 1.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	3¼	—	3 17 5
City of London	1	7½	7½	37/6	−6d.	4 0 0
Clyde Valley	1	7	8	41/-	+1/-	3 18 0
County of London	1	10½	10½	53/6	+6d.	3 19 0
Edmundson's 7% Pref.	1	7	7	35/-	—	4 0 0
Do. Ord.	1	7	8	41/-	+6d.	3 18 0
Elec. Dis. Yorkshire	1	9	9	46/6	−6d.	3 17 9
Elec. Fin. and Securities	1	12½	12½	3¾	—	3 14 2
Elec. Supply Corporation ...	1	11	11	3 1/16	—	3 11 10
Lancs Light and Power	1	7½	7½	36/-	+6d.	4 3 6
Lond. Assoc. Electric	1	—	—	33/9	+1/9	4 2 6
London Electric	1	7	8	38/6	—	4 3 0
London Power deb. Red.... ...	Stock	5	5	108½	—	4 12 4
Metropolitan	1	10	10	51/-	—	3 18 6
Midland Counties	1	7	7	35/6	—	3 19 0
Mid. Elec. Power	1	8	8	40/9	—	3 18 6
North Eastern Electric Ordinary	1	6	6	32/0	—	3 15 0
Do. 7% Pref.	1	7	7	34/-	−6d.	4 2 2
Northampton	1	10	10	50/-	− 1/16	4 0 0
Notting Hill 6% Pref.	10	6	6	14½	—	4 2 9
North Met. Elec. Ordinary ...	1	10	10	57/6	—	3 9 5
Do. do. 6% Pref.	1	6	6	31/6	—	3 16 2
Scottish Power	1	8	8	39/-	+6d.	4 2 0
South London	1	7	7	33/6	—	4 3 7
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	23/6	—	6 7 8
Yorkshire Elec.	1	8	8	42/6	−6d.	3 15 5
PUBLIC BOARDS.						
Central Electricity, 1950–70 ...	Stock	5	5	115	—	4 7 0
Do. 1955–75 ...	,,	5	5	117	—	4 5 6
Do. 1951–73 ...	,,	4½	4½	110	—	4 1 10
Do. 1963–93 ...	,,	—	3½	102	—	3 8 6
London Elec. Trans. Gtd. ...	,,	—	2½	95	+1	2 12 6
London & Home Counties, 1955–75	,,	4½	4½	114	—	3 19 0
London Passenger Transport, A...	,,	—	4½	122½	—	3 12 10
Do. do. B...	,,	—	5	128½	−1	3 19 0
Do. do. C...	,,	3	—	101	+1	2 19 5
West Midlands Joint Elec. 1948–68	,,	—	5	115	—	4 7 0
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$100	9	9	143½	+2	6 5 4
Anglo-Am. Tel. Pref.	Stock	6	6	116	—	5 3 0
Do. Def.	,,	1½	1½	27½	—	5 9 1
Cable & Wireless 5½% Pref. ...	,,	2¾	4½	95½	—	4 6 7
Do. A. 7½% Ord.	,,	Nil	Nil	23	+1	—
Do. B. Ord.	,,	Nil	Nil	6¼	—	—
Globe Tel. & Tel. Ord.	10	2½	3½*	13	—	2 13 10
Do. do. Pref.	10	6	6	13½	−½	4 9 0
Great Northern Tel.	10	20	20	40	—	5 0 0
Marconi-Marine	1	10	7½	31/3	− 1/16	4 16 0
Oriental Telephone Ord.	1	12	12	3 1/16	—	*3 15 1
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref. ...	5	Nil	Nil	1/6	—	—
Do. do. 2nd Pref.	5	Nil	Nil	1/6	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	5	—	—
British Electric Traction Df. Ord.	,,	5	5	1050	—	—
Do. do. Pref. Ord.	,,	8	8	170	—	4 14 2
Brazil Traction	100	—	—	7½	−¼	—
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	98½	—	5 1 6
Mexican Light Common	100	Nil	Nil	2½	—	—
Do. 7% Pref.	100	7	7	4½	—	—
Do. 1st Bonds	$500	5	5	35	—	—
Victoria Falls Ord.	1	20	20	3¾	+¼	—
West Riding	1	5	6½	40/0	− 1/16	3 4 0
MANUFACTURING COMPANIES.						
Aron Electricity Ord.	1	10	15	2 1/16	—	5 2 0
Assoc. Elec. Ord.	1	4	6	34/6	+6d.	3 9 7
Do. Pref....	1	8	8	37/6	—	4 5 4
Babcock & Wilcox	1	6	8	48/9	—	3 5 4
British Aluminium Ord.	1	5	7½	40/9	−9d.	3 12 4
British Insulated Ord.	1	5	15	4¼	—	3 8 8
Brush Ord.	Stock	Nil	Nil	46½	−1	—
Callender's	1	15	15	3½	—	4 2 10
Do. 6½% Pref.	1	6½	6½	32/6	—	4 0 0
Crompton Parkinson Ord. ...	5/-	—	12½	3½	+¼	0 17 10
Do. 8% Pref.	1	8	8	37/6	—	4 5 4
Edison Swan 1st Pref.	1	7½	7½	27/6	—	5 9 0
Electric Construction	1	Nil	3½	24/3	—	2 17 9
Enfield Cable Ord.	1	25	25	4½	− 1/16	5 2 6
English Electric	1	Nil	Nil	17/-	+2/-	—
Do. do. Pref.	1	Nil	Nil	1½	+¼	—
Ericssons Tel.	1	—	24	7 1/16	+ 1/16	3 8 1
Ever Ready	5/-	35	35	22/6	+6d.	7 15 6
Ferranti Pref.	1	7	7	28/-	—	5 0 0
G.E.C. Pref.	1	6½	6½	32/6	—	4 0 0
Do. Ord.	1	8	10	3½	+ 1/16	3 4 0
Henley's	1	30	30	6 1/16	—	4 8 0
Do. 4½% Pref.	5	4½	4½	5½	—	3 16 8
India-Rubber Preferred	1	—	5½	1½	—	4 17 9
Johnson & Phillips	1	5	7½	41/3	—	3 12 9
Siemens Ord.	1	6½	4	23/9	+ 1/16	3 7 4
Telegraph Construction	£1	Nil	Nil	23/9	+ 1/16	—

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1933

33317. "Television, telekinematographic, and like systems and apparatus." J. L. Baird and Baird Television, Ltd. November 28th, 1933. (434527.)

33953. "Method and means for regulating voltages, speeds and temperatures." E. Wolniewicz and A. E. Sierzputowski. December 2nd, 1933. (Convention date not granted.) (434716.)

34185. "Remote electric control systems." General Electric Co., Ltd., and H. J. Coates. December 5th, 1933. (434717.)

34617. "Suppression of disturbing frequencies from electric networks." British Thomson-Houston Co., Ltd. December 8th, 1932. (434715.)

1934

674. "Electric discharge lamps." British Thomson-Houston Co., Ltd., W. J. Scott, J. G. Brett and C. E. Fenwick. January 8th, 1934. (Cognate application 819/34.) (434720.)

6002. "Electrically heated incubators." G. T. Church. February 23rd, 1934. (434487.)

6510. "Television and like receiving systems." Marconi's Wireless Telegraph Co., Ltd. February 28th, 1933. (434496.)

6966. "Electric discharge devices." British Thomson-Houston Co., Ltd., and L. J. Davies. March 5th, 1934. (434597.)

6967. "Electric discharge devices." British Thomson-Houston Co., Ltd., and W. J. Scott. March 5th, 1934. (434598.)

7145. "Magneto-electric machines." British Thomson-Houston Co., Ltd., and L. Griffiths. March 6th, 1934. (434667.)

7146. "Control systems for dynamic braking of electric motors." British Thomson-Houston Co., Ltd., H. W. C. Liddiard, and T. H. Petch, Junr. March 6th, 1934. (434668.)

7347. "Thermionic valve circuits." Telefunken Ges. für Drahtlose Telegraphie. March 8th, 1933. (Cognate application 7348/34.) (434729.)

7425. "Traffic-control systems." Automatic Electric Co., Ltd., and T. P. Preist. March 8th, 1934. (434732.)

9234. "Connectors for electric irons." C. D. Harvey. March 23rd, 1934. (Cognate application 2458/35.) (434609.)

9660. "Method and apparatus for television or other purposes associated, if desired, with a wireless apparatus and gramophone." J. Guibiansky. March 20th, 1935. (434544.)

9846. "Control of electric motors." Igranic Electric Co., Ltd., and J. V. Levett. March 29th, 1934. (434611.)

10316. "Alternating-current electricity meters." Ferranti, Ltd., D. Z. de Ferranti and F. H. Batt. April 5th, 1934. (434613.)

10338. "Electric motor controllers." Igranic Electric Co., Ltd. April 6th, 1933. (434545.)

10674. "Electric discharge tubes." General Electric Co., Ltd., J. T. Randall, N. L. Harris, and J. W. Ryde. April 9th, 1934. (434614.)

11416. "Circuits for feeding electric discharge tubes." General Electric Co., Ltd., N. L. Harris, and W. H. Pritchard. April 16th, 1934. (434615.)

12176. "Electric cookers." General Electric Co., Ltd., and G. S. Cattell. April 23rd, 1934. (434549.)

13352. "Sealing devices for electrically driven submersible pumps." Drysdale & Co., Ltd., and J. Young. May 3rd, 1934. (434505.)

16645. "Controlling mechanisms for moving apparatus, more particularly for winding, hoisting, hauling, and like gear." G. D. Smith, and Associated Electrical Industries, Ltd. June 4th, 1934. (434621.)

17410. "Electric thermal cut-outs." L. Satchwell. June 12th, 1934. (434553.)

18094. "Controlling apparatus for electric motors." J. G. Smithson and J. G. Smithson & Co., Ltd. June 19th, 1934. (434556.)

20265. "Regulation of currents having high or musical frequencies superimposed on distribution networks." Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. July 11th, 1933. (434559.)

20919. "Method and apparatus for the production of electric high-frequency conductors of the recurrent type." Siemens-Schuckertwerke Akt.-Ges. July 17th, 1933. (434560.)

22951. "Electric discharge devices." General Electric Co., Ltd. (Patent Treuhand Ges. für Elektrische Gluhlampen). August 8th, 1934. (434561.)

25101. "Motor-operated step-by-step electric switches." Landis & Gyr Akt.-Ges. September 15th, 1933. (434564.)

28303. "Spark-gaps for excess-voltage electrical protection devices." Siemens-Schuckertwerke Akt.-Ges. October 3rd, 1933. (Cognate application 28304/34.) (434572.)

32124. "Electric wave transmission networks." Standard Telephones & Cables, Ltd. January 31st, 1934. (434632.)

33993. "Telephone systems, adapted for recording and reproducing the transmissions." O. Jaeger. November 26th, 1934. (434634.)

34056. "Electrical resistance thermometers." W. Bonwitt. December 1st, 1933. (434635.)

35198. "Radio transmitters." Marconi's Wireless Telegraph Co., Ltd. December 16th, 1933. (434637.)

1935

1476. "Short-wave radio communication." J. Pintsch Akt.-Ges. and Dr. K. Kohl. January 16th, 1934. (434638.)

3106. "Telegraph systems." Soc. d'Etudes pour Liaisons Téléphoniques et Télégraphiques à Longue Distance. March 29th, 1934. (Cognate application 3107/35.) (434642.)

3382. "Electron-discharge devices." Telefunken Ges. für Drahtlose Telegraphie. February 2nd, 1934. (Cognate applications 3383/35 and 3384/35.) (434643.)

5335. "Sockets for contact plugs of thermionic valves and the like." Cinch Manufacturing Corporation. February 23rd, 1934. (434766.)

7283. "Hot-cathode discharge apparatus." W. W. Triggs (Akt.-Ges. Brown, Boveri & Cie.). March 8th, 1935. (434687.)

8106. "Electrode-feeding devices for welding machines." British Thomson-Houston Co., Ltd. March 17th, 1934. (434691.)

11692. "Acoustic horns." Electrical Research Products, Inc. April 25th, 1934. (434774.)

13446. "Electrodes for arc welding." British Thomson-Houston Co., Ltd. May 8th, 1934. (434524.)

15427. "Circuit arrangements comprising a gasfilled incandescent electrode-discharge tube." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. July 20th, 1934. (434713.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from September 25th:—

Chronomatic. No. 561497. Class 8. Time-registering apparatus and automatic apparatus for giving audible warnings and for lighting lamps and indicators at fixed and variable intervals.—Telephone Manufacturing Co., Ltd., Hollingsworth Works, Martell Road, West Dulwich, S.E.21.

Conda. No. 562025. Class 8. Electrical condensers.—Kahla Porzellan Fabrik Gesellschaft, Kahle, Thuringia, Germany. (British representatives: Dicker, Pollak, Mercer, Tench and Meyer, 20-23, Holborn, E.C.1.)

Spenco. No. 562099. Class 18. Arc welding plant.—C. L. Spence, Ltd., 57, Gracechurch Street, E.C.3.

Dotic. No. 562490. Class 18. Electric geysers.—Burslem's Patents, Ltd., Midland Bank Chambers, 20, Kingsway, W.C.2.

United States Electrical Exports

BELOW are given the values of the exports of electrical machinery and cognate material from the United States during the first half of the present year, as compared with the corresponding six months of 1934. Although the various items show considerable fluctuation the grand total for this year is about 17 per cent. higher.

	January–June. 1934. £	1935. £
D.c. generators	8,180	6,375
A.c. generators under 2,000 kVA	10,254	35,057
A.c. generators over 2,000 kVA	46,655	43,545
Steam turbo-generators	13,234	37,267
Generator parts and accessories	37,373	38,486
Arc welding sets	25,840	42,514
Self-contained lighting sets	17,765	22,225
Storage batteries, 6 and 12 V.	101,852	108,095
Other storage batteries	37,966	52,490
Dry cells	221,670	260,152
Power transformers over 500 kVA	8,760	10,084
Distribution transformers under 500 kVA	28,648	39,437
Instrument transformers	6,320	14,965
Other transformers	16,220	20,883
Non-rotating battery chargers	2,912	4,036
Motor generators, dynamotors, synchronous, and other convertors	13,667	21,045
Switchboard panels (not telephones)	20,103	25,296
Switches and circuit breakers over 10A	53,170	79,527
Fuses	10,239	11,410
Watt-hour and other measuring meters	25,104	40,442
Electric indicating instruments	40,910	48,212
Electric recording instruments	19,323	27,022
Other electric testing apparatus	60,042	59,138
Lightning arresters, choke coils, reactors and parts	28,460	53,850
Motors under 1 h.p.	74,019	70,564
Motors up to 200 h.p.	78,639	98,556
Motors over 200 h.p.	8,007	20,699
Railway motors	20,080	7,042
Electric railway locomotives	8,420	10,508
Mining and industrial electric locos	33,274	33,432
Railway and warehouse electric trucks	10,150	14,459
Starting equipment for motors	79,850	97,935
Portable electric tools	75,815	86,854
Accessories and parts for motors	91,600	121,265
Electric household refrigerators	718,660	919,086
Electric commercial refrigerators	225,488	227,531
Electric refrigerator parts	348,046	421,908
Flashlight cases	43,679	67,174
Electric fans	45,333	40,504
Incandescent lamps	93,184	109,765
Searchlight and airport beacons	10,200	2,368
Floodlights	7,596	10,432
Electric household washing machines	24,366	46,830
Electric domestic vacuum cleaners	22,821	22,190
Other household electric devices	31,893	38,120
Electric irons	9,583	16,752
Electric cooking ranges	17,653	21,250
Other household heating and cooking devices	25,917	35,616
Industrial electric furances, ovens, etc.	23,858	33,218
Therapeutic and X-ray apparatus	97,087	132,112
Radio transmitting sets and parts	97,240	177,066
Radio receiving sets	1,413,232	1,383,740
Radio valves	291,087	273,547
Radio receiving set components	390,661	406,596
Radio loudspeakers	28,569	45,247
Other radio receiving apparatus	40,073	49,413
Telegraph apparatus	32,568	20,252
Telephone instruments	13,252	31,557
Other telephone equipment	92,072	130,927
Bells, buzzers and alarms	8,839	15,460
Starting, lighting and ignition equipment	117,927	133,480
Sparking plugs	158,065	174,995
Insulating material	26,255	27,619
Metal conduit and switch boxes	39,599	55,410
Sockets, fuseblocks and lighting switches	84,893	88,758
Electric interior lighting fixtures	48,753	60,613
Electric exterior lighting fixtures	9,307	15,214
Other wiring supplies and line material	48,787	75,154
Other electrical apparatus	314,007	469,160
Glass electric insulators	4,788	18,652
Porcelain electric insulators	31,195	53,862
Electric hard rubber goods	12,298	16,315
Nickel-chrome electric resistance wire	41,787	31,583
Furnace electrodes	171,196	147,642
Carbon brushes	17,840	20,112
Insulated copper wire and cable	157,532	175,046
Iron and steel cable	1,187	1,073

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Amble (NORTHUMBERLAND).—Houses (20), Percy Street, for M. B. Coxon & Sons, builders, Red Row, Morpeth.

Audenshaw.—Cinema and shops, Stockport Road, Guide Bridge, for a local syndicate; P. Hamer, Ltd., builders, 15, Park Street, Swinton.

Beckenham.—Houses (26), Southend Road; Spencer & Kent. School, Coney Hall estate; director of education.

Bedford.—Church, Barford Avenue; Methodist trustees. Library; borough engineer.

Blackpool.—Houses (31), near Warley Road, North Shore; J. Fielding & Sons (Blackpool), Ltd., builders, Ashburton Road.

Bournemouth.—Houses (84); F. P. Dolamore, borough engineer.

Braintree.—Houses (26), and bungalows, Panfield Lane estate; U.D.C. surveyor.

Brighton.—Houses (200), Chichester estate; borough engineer. Cinema and restaurant, West Street; General Cinema Theatres, Ltd.

Cannock.—Unemployed Centre, Hall Court Lane; H. Crockett, architect, Council Offices. Senior school, Littleworth, for E.C.; E. Swift, secretary.

Carlisle.—Central schools, for City E.C.; H. Buckland, architect. Senior school, Currock; director of education.

Chatham.—Houses (107); borough surveyor.

Chester-le-Street.—Houses (45); direct labour under supervision of surveyor.

Clacton-on-Sea.—Church, Kirby Cross, for the Methodist trustees; W. G. Crane, circuit secretary.

Clutton (BRISTOL).—Houses (24); Thomas & Morgan & Partners, architects, 23, Gelliwastad Road, Pontypridd.

Colwyn Bay.—Alterations and additions, with electric lifts, to 6-7, Station Road, for D. Allen & Sons.

Coventry.—Elementary school, Keresley, and extensions to Foxford School, for E.C. Extensions to Longford Generating Station (£306,000); electrical engineer, Council House.

Cumberland.—Schools, Waberthwaite, for County E.C.; Curwen & Coldwell, architects, Highgate, Kendal.

Darlington.—Church, Brinkburn Road, for the Church Council of St. Matthews; C. W. Milburn, architect, Feethams.

Dover.—Houses (110), St. Radigund's estate; Lewis & Sons, builders.

Droylsden.—Cinema; W. Parkinson.

Dudley.—Shops and flats, New Street; borough engineer. Junior school, Wren's Nest estate, for E.C. Extensions to works, Hope Street; W. Goodyear, Ltd.

Dundee.—College of Art (£60,000); J. Keay, clerk, Institute of Art and Technology.

Dursley.—Houses (20), Wotton-under-Edge; Channing & Osmond, builders, Burnham-on-Sea.

Eccles (LANCASHIRE).—Senior schools (£51,970), for Borough E.C.; Jonathan Partington, Ltd., builders, Middleton Junction.

Edinburgh.—Houses (306), Granton Mains; city architect.

Erith.—Rebuilding Oxford Cinema; Robert Cromie, architect, London, W.1.

Eston (YORKSHIRE).—Houses (292); U.D.C. surveyor, Cleveland House, Grangetown.

Glasgow.—Gymnasium and bath, Eastbank Secondary School, for E.C. Two laundries and machinery for Scottish Co-operative Wholesale Society (£92,000); architect, Scottish Co-operative Wholesale Society, Glasgow. Offices, Buchanan Street, for L.M.S. Railway Co. (electrical work); architect's department. Six-storey buildings, Hyndland Road; Keystone Constructions, Ltd.

Guildford.—Shopping arcade, North Street; Gammons, Ltd.

Hambledon (SURREY).—Houses (135); P. G. Williams, R.D.C. surveyor.

Hamilton.—Brickmaking factory for Findlay & Co., Rutherglen; the manager.

Ipswich.—Houses (68), Gainsborough estate (electrical work); borough surveyor, Town Hall.

Irish Free State.—(DUBLIN).—Houses (485), Crumlin area; housing architects. National schools, Seville Place; A. E. Smith, quantity surveyor, 19, Upper Merrion Street.

Isle of Man.—School, Pulrose, Braddan, for E.C.; A. J. Davidson, architect, 16, Athol Street, Douglas.

Jarrow-on-Tyne.—Houses (150); borough engineer.

Kent.—School, Mill Pond Wood, Sevenoaks; county architect, Maidstone.

Lancashire.—Mental hospital, Latham Hall estate, near Ormskirk, for the Lancashire Mental Hospitals Board (£1,500,000), with electrical work.

Leeds.—Modernisation, St. James's Hospital (£110,000); Health Committee. Extensions to Kirkstall Power Station (£180,000); S. Butler & Co., Ltd., constructional engineers, Stanningley.

Lincoln.—Houses (100), Monks Tower estate; M. A. Hall, architect, Silver Street.

London.—(BERMONDSEY).—Clinic, Silver Street; Medical Officer of Health. Flats and shop, Arnolds Place area (£17,327); B.C. Works manager. (Bow).—Additions to Palace Cinema, Bow Road; Kemp & Tasker. (HAMMERSMITH).—Buildings, Addison Gardens and Richmond Road; Sir Aston Webb & Son, 19, Queen Anne's Gate, S.W.1. Block of flats, 353-7, Goldhawk Road; Roy Gibson, Ltd., Templeton estate, Priory Lane, S.W.15. Flats (274), Emlyn Street and tenements, Becklow Place; borough engineer. Second section, Queen Charlotte Hospital, Goldhawk Road; Stanley Hall & Easton & Robertson, architects, 54, Bedford Square, W.C.1. (LEWISHAM).—Estate development, Marvels Lane; Henry Dawson & Son, 20, Ludgate Hill, E.C.4. (POPLAR).—Factory, Old Ford Road; Steel Ceilings, Ltd., 415, Old Ford Road, E.3. Extensions to 255-7, Roman Road; W. Silk & Son, Ltd., 13, High Street, E.9. Extensions to works, Beach Road, for Broadwood & Co.; Newalls Insulation Co. (ROTHERHITHE).—Rebuilding 242-6, Rotherhithe Street, for Bellamy's Wharf Co.; H. A. Scrase, architect, 16, St. Helen's Place, E.C.3. (ST. PANCRAS).—Extensions and subway to University College Hospital, Huntley Street; Governors. (SYDENHAM).—Estate development, West Hill; Marshall & Tweedy, 4, Cavendish Place, London, W.1.

Luton.—Court house and police station, electrical work (£25,000); Basil C. Deacon, architect, King Street.

Manchester.—Telephone exchange, Rusholme; H.M. Office of Works, Storey's Gate, London, S.W.1.

Mansfield.—Extensions to works, Midworth Street; Mansfield Hide & Skin Co.

Middlesbrough.—Houses, Acklam Garden Village estate; E. T. Sweeting, builder, Bk. Haymore Street. Houses (60), Chelford Oakes; T. Crawford, builder, 32, Borough Road. Houses, north of Levick Crescent; W. A. King & Sons, Ltd., builders, Westbourne Grove, North Ormesby. Hotel for Younger & Co., Ltd., Brambles Farm trunk road near Cargo Fleet Lane; S. H. Clarke, architect, 108, Borough Road. Institute for the Brambles Farm Tenants' Association; Archibald and Archibald, architects, 26, Albert Road. Alterations and additions to premises, Dock Street, for Storrow & Co.; H. Moore, architect, 61, Albert Road. Extensions to premises, Church Street, for Parkinson & Sons, Ltd.; H. Moore, architect, 61, Albert Road.

Middlesex.—Girls' secondary school, Hampton (£40,000), for County E.C.; H. M. Walton, secretary, Eccleston Square, London, S.W.1.

Minchinhampton (GLOUCESTERSHIRE).—Houses (25), Old Common Road and Cirencester Road, for W. J. Kirby.

Morecambe.—Houses (22), Tibicar Drive; F. Armistead. Houses (24), near West End Road; F. Fisher. Extensions to Regal Hotel, Marine Road; Mrs. A. Bourne. Extensions to works, Westgate; Morecambe Electrical Equipment Co., Ltd.

Neath.—Schools, Crythan Park, for Borough E.C.; A. J. Evans, clerk.

Newcastle-on-Tyne.—Houses (74), Weidner Road; Hadden & Hillman, Ltd., builders, Huddlestone Road. Church of the Holy Cross, Fenham (electrical work); J. & W. Lowry, builders, Newcastle-on-Tyne. Soap factory with offices, City Road, for Thomas Hedley & Co., Ltd.; staff architect, Collingwood Street.

New Malden.—Development of Mid-Coombe estate, Trapps Lane; Cannon Hill Estates, Ltd.

Northwich.—Houses (70), Weaverham; J. Birtwistle, R.D.C. surveyor.

Ormskirk.—Factory, near Town Green Station, for Tattis Potato Crisps, Ltd., Aughton.

Rauceby (LINCOLNSHIRE).—Extensions to Mental Hospital (£70,000); Joint Visiting Committee.

Renfrew.—Houses (100), Woodhall estate, Kilmacolm; J. Murray, burgh surveyor, Anderson Street, Port Glasgow.

Sevenoaks.—Bakery, Suffolk Place; South Suburban Co-operative Society.

Southport.—Art school (£16,000); director of education.

South Shields.—Houses (36) and bungalows, Marsden Road, Fairway Avenue and Harton Lane East; G. R. Smith and Partners, Ltd., architects, 3, Winchester Street. Alterations to the Palladium Cinema, for Thompson's Enterprises, Ltd.; J. H. Morton & Sons, architects, Fowler Street.

Spalding.—Houses (44); F. Bernard Saunders, architect.

Sunderland.—Cinema, Pallion Road; W. and T. R. Milburn, architects, 17, Fawcett Street.

Swindon.—Municipal buildings (£54,500); Bertram & Rice, architects, 28, Holywell Street, Oxford.

Teddington.—Mill and workshops, High Street; W. & F. Doughty, 97a, High Street, Teddington.

Thornton Heath.—Shops and flats, London Road; C. F. Pickering, 117, Parkway, Romford. Extension to factory, Thornton Road; R. & A. Main, Ltd., Gothic Works, Edmonton, N.18.

Thurnscoe.—Houses (82), Grange estate; H. R. Bridger, surveyor, Council Offices, Low Grange.

Torquay.—Central library; borough engineer.

Truro.—Extensions to Diocesan Training College (£23,000); Dr. J. W. Hunkin, chairman of the College Council.

Tynemouth.—Houses (26) for aged people, Eidges estate; borough engineer. Houses, Broadway and Links Avenue; J. R. Wallace, architect, 20, Northumberland Square, North Shields. Houses and shops, Billy Mill Avenue; J. Dixon, builder, Lynn Road, North Shields. Alterations to Russell Street and Sidney Street for W. H. Smith & Sons, Ltd.; Hetherington & Wilson, architects, 52, Westgate Road, Newcastle-on-Tyne.

Urmston.—Houses (99), Derwent estate, Flixton; J. H. Conway, Goldsworthy Road, Flixton.

Walsall.—Technical College (£80,000), for E.C.

Warrington.—Offices, Thelwall Lane; Pierpoint & Bryant, Ltd.

Welwyn Garden City.—Houses (116); Handside Lane, for Welwyn Garden City Co., Ltd.; secretary.

West Hartlepool.—Cinema, York Road (£45,000), for Metcalf Bros.

West Sussex.—Infants' school, Fishergate, near Portslade-on-Sea; county architect.

Whickham-on-Tyne.—Houses (74), Dunston and Broom Lane, for the U.D.C.; direct labour under supervision of Thomas Fenbow (surveyor).

Whitefield.—Houses (68); C. F. Porter, clerk to the Council, Town Hall.

Wolverhampton.—Extensions to schools (£85,000) with electrical work); director of education, Council House.